Agriculture

PUBLISHED 6d MONTHLY

Lessons from the Counties

Reproduced from the original by permission of THE COUNTRYMAN LTD.

Squarely set on our southern coastline, Hampshire shares its agricultural problems with its neighbours.

To the north the dry downland rolls to the Berkshire ridgeway, to the west the barren wastes of the New Forest drift into Dorset, and to the east the county merges imperceptibly into sweet Sussex and suburban Surrey. Although a large part of the county is predominantly arable, dairy and other grass-fed stock are found everywhere. The chief problem is to grow grass that will resist drought, be summer green, have leaf width and bulk to fill the animals during the grazing season, and provide succulent silage for the winter. Throughout the county, soil fertility has been promoted by fertilizers assisted by dung naturally deposited.

The soil of much of the county is thin, so short-term leys are the general practice, and with such swards the vital factor for increased production is nitrogen.

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1

M/50/8

Piped Water to Rural Areas

mole laying

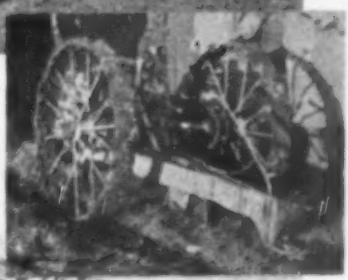
does the job fifty times quicker !

Above: *The end of a 580 ft. pipe run on the Rozelle Estates, Ayrshire, Scotland.*

Further recent installations, photographs of a few of which are shown here, demonstrate the popularity of mole laying "Yorcalon" copper underground water pipelines. By this method, the laying time is reduced to a matter of minutes compared with the lengthy and costly procedure of manual trenching.

If you are considering the installation of a piped water supply, it will pay you to investigate the advantages of mole laying "Yorcalon" copper tubes. Joined by "Yorkshire" fittings, they provide permanently reliable and trouble-free service – without repairs or replacements – throughout a long working life.

Further particulars will gladly be sent on request.



Above and Top Right: *750 ft. of "Yorcalon" pipeline being pulled in at Bankhouse Farm, Pudsey, Yorkshire.*

Right: *"Yorcalon" tubing being pulled in by winch-hauled mole plough at Carr Hill Farm, Gildersome, Yorkshire.*

Above: *920 ft. of "Yorcalon" pipeline being laid at Carrington Mains, Gorebridge, Scotland.* (Photograph by courtesy of "Farming Forms", Glasgow.)

"Yorcalon" COPPER TUBES

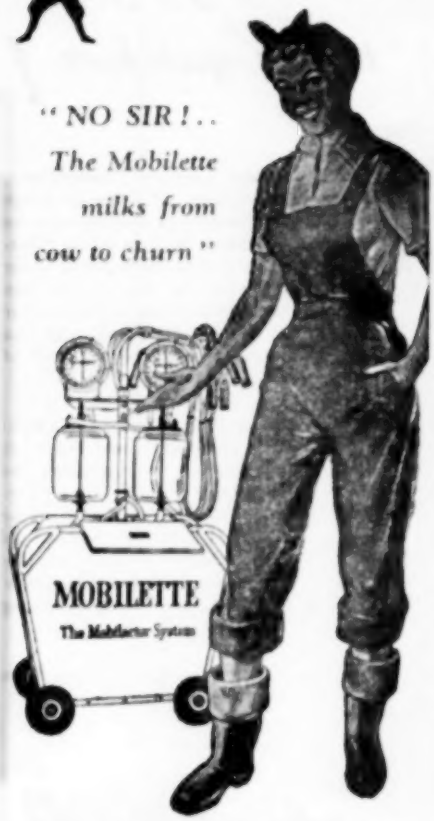
FOR PERMANENTLY RELIABLE & TROUBLE-FREE UNDERGROUND WATER PIPELINES

THE YORKSHIRE COPPER WORKS LTD.
LEEDS and **BARRHEAD, SCOTLAND**

BY APPOINTMENT
MANUFACTURERS OF MILKING MACHINES TO H.M. KING GEORGE VI

"Milking troubles?"

"NO SIR!.. The Mobilette milks from cow to churn"



This latest addition to the **Gascoigne Mobilactor System** is a 2-point mobile milking machine specially designed for use in smaller-sized cowsheds. It has all the well-known Gascoigne features—is sturdily built, easy to clean, economical to operate, and *absolutely dependable*. Send today for details, or ask your local dealer for a demonstration.

GASCOIGNES

BERKELEY AVENUE · READING

Telephone: 5067 & 2273

W.W.81

'ALBERT'

Basic Slag

FOR ALL CROPS

★ *Literature and advice free from J. Harold Thompson, B.Sc.(Agric.) Chief Agricultural Adviser BRITISH BASIC SLAG LTD., Wellington House, Buckingham Gate, S.W.1, WHitehall 2904 or in Scotland to J. S. Symington, B.Sc. (Agric.), 37 Castle Street, Edinburgh. Tel. Edinburgh CENtral 6350.*

Jack **BARCLAY**

LIMITED

The Largest Official Retailers of ROLLS-ROYCE & BENTLEY

Stock List of Used Cars on request.

Showrooms: Hanover Square, London, W.1. MAYfair 7444

Service Works: Lambard Road, Morton, S.W.19. LIBerty 7999

HIGH SPEED BEET LIFTING AT LOWEST COST

Fordson MOUNTED Root Harvester

Lifts, cleans, windrows—in one operation!

LIFTING is quick, collection is easy and the entire cost of beet harvesting is reduced when you use the Fordson Root Harvester! Actual field tests have proved this fact.

Working on the latest principles this modern Beet Harvester lifts two rows of beet at once with special lifting shares. The beet are then guided from the shares and laid on a power-driven spinner, which cleans and delivers them through adjustable rear gates. A simple gate adjustment makes it possible to windrow four rows into one—an advantage which considerably speeds up collection. Like all Fordson Tool Bar implements, this Root Harvester is remarkable for its ease of handling and instant readiness for transport. And of course it's backed by the nation-wide Fordson Tractor Dealer Service Facilities with spares at *low fixed prices*. Whether you farm 4 or 40 acres of beet, you should see this Root Harvester at work. It's worth serious consideration!

STOP PRESS

FORDSON ROOT HARVESTER
AWARDED
SILVER MEDAL
by Royal Agricultural Society of England
Oxford Show 1950

Fordson
MAJOR TRACTOR

FORD MOTOR COMPANY LIMITED DAGENHAM

Please mention the JOURNAL *when corresponding with Advertisers*

Pull more profits from your land

with the

McCORMICK

INTERNATIONAL

FARMALL M

The Farmall M is the most profitable investment the farmer can make. It has the extra power and speed that saves time, the extra ease of operation that saves labour, the extra stamina that cuts maintenance costs. Precision built to stand up to years of the toughest going over the largest acreage, it will handle every job with the utmost efficiency. Implements can be speedily attached and detached. Everything is under control from the tractor seat. There is high clearance for row crop work and exceptional manœuvrability for awkward field corners.

• *4 cylinder engine with Tocco-hardened crankshaft, and replaceable precision bearings.* • *32.86 H.P. at drawbar. 36.70 H.P. at belt.* • *Outstanding fuel economy.* • *Five speeds forward and reverse.* • *Adjustable wheel tread, front and rear.* • *Full protection against dust, dirt and water.* • *Heat indicator and radiator shutter control.*

IF IT'S AN IH MACHINE IT'S A REAL INVESTMENT

For further information see your IH Dealer.

INTERNATIONAL HARVESTER

INTERNATIONAL HARVESTER CO. of GREAT BRITAIN LTD. "Harvester House," 259, City Road, London, E.C.1

Works: Wheatley Hall Road, Doncaster; Carroll Park, Bootle, Liverpool

---

Webbs'

THE
PRODUCERS OF PEDIGREE SEEDS AND
MANUFACTURERS OF FERTILIZERS

Webbs' CEREALS, GRASSES and CLOVERS, COMPOUND FERTILIZERS for Autumn Sowing

Catalogues will be sent post free upon request to either their Head Office or one of their local Representatives

EDWARD WEBB & SONS (Stourbridge) LTD.,
2 WORDSLEY STOURBRIDGE WORCS.
Telephone: Brierley Hill 7575 (4 lines)

'Of course they'll sell well' . . .

Wise pig feeders insist on buying Silcock fed stores (even though they have to pay a bit more for them) because they know that the pig well started is the best paying proposition.

And it only takes eight bags of Silcocks Pig Meal to feed a sow and a litter of eight from service to weaning.

R. SILCOCK & SONS LIMITED · STANLEY HALL · EDMUND STREET · LIVERPOOL 3

Please mention the JOURNAL *when corresponding with Advertisers*

"Has everything"

says Mr. M. Alderson *of Much Wenlock*

"I have now completed the round of seasonal work and am amazed at the quiet efficiency with which The Nuffield Universal does any and every job. Its power is surprising on this stiff soil and hilly country. Its fuel economy is considerable and its flexibility has to be experienced to be believed. I reckon it is a better paying proposition than the smaller tractors I've had."

NUFFIELD
UNIVERSAL

MORRIS MOTORS LTD. (AGRICULTURAL DIVISION), COWLEY, OXFORD. *Overseas Business:* NUFFIELD EXPORTS LTD., OXFORD AND 41, PICCADILLY, LONDON, W.1.

A NUFFIELD PRODUCT

Please mention the JOURNAL *when corresponding with Advertisers*

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

Editorial Offices: St. Andrew's Place, Regent's Park, N.W.1 *(Phone: WELbeck 7711)*

VOL. LVII No. 5 AUGUST 1950

¶ *Provided that the source is acknowledged in each instance, such articles and notes as are published in this Journal without any specific reservation regarding copyright may be reproduced in any registered newspaper or public periodical without special permission. The Ministry does not accept responsibility for statements made, or views expressed, in signed contributions to this Journal or in those reproduced from another source.*

¶ *Further, the Ministry does not accept responsibility for any of the private and trade advertisements included in this publication.*

¶ *All communications respecting advertising in the Journal should be addressed to the Advertisement Contractors, Aldridge Press, Ltd., 15 Charterhouse Street, London, E.C.1. Telephone: Holborn 8655.*

Contents

	Page
Farming an Airfield. *L. J. McHardy* and *J. Y. Holmes*	201
Condensed Fish Solubles in Poultry and Pig Foods. *R. Coles* and *A. R. Preston*	205
Crude Fibre in Feedingstuff Analysis. *Brynmor Thomas* and *D. G. Armstrong*	210
Potato Root Eelworm in Jersey. *T. Small, E. Dunn* and *G. E. Thomas*	212
Parsnip Canker. *D. E. Green* and *M. Ann Hewlett*	216
Farming in Southern Rhodesia. *S. M. Makings*	223
Dry Rot of Potatoes. *C. E. Foister* and *A. R. Wilson*	229
Carnations for the Cut Flower Market. *Peter H. Chaplin*	234
Packing Apples in Returnable Market Boxes. *Robert Hart* and *N. Stewart*	236
Course for Landowners. *J. E. Thorpe*	239
Farming Affairs	242
Agricultural Machinery Census, 1950	245
Book Reviews	247

Cover Photograph

The Crown of the Year

PROSPECT FOR THE LAND

by L. J. Easterbrook

A book about farming in Britain - past, present and future - prepared by the Economic Information Unit and the Central Office of Information to show both countryman and townsman the vital role which agriculture has to play in giving a firm and lasting foundation to Britain's economic recovery.

Sixty excellent half-tone illustrations

1s. (1s. 2d. by post)
from
H.M. STATIONERY OFFICE

York House, Kingsway, LONDON, W.C.2 — 429 Oxford Street, LONDON, W.1
P.O. Box 569, LONDON, S.E.1
13a Castle Street, EDINBURGH, 2 — 1 St. Andrew's Crescent, CARDIFF
39 King Street, MANCHESTER, 2 — 1 Tower Lane, BRISTOL, 1
2 Edmund Street, BIRMINGHAM, 3 — 80 Chichester Street, BELFAST
or from any Bookseller

AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL. LVII No. 5 AUGUST 1950

FARMING AN AIRFIELD

A PROBLEM OF RESTORATION

L. J. McHARDY, M.Sc., N.D.A., and J. Y. HOLMES, N.D.A.

National Agricultural Advisory Service, E. Midland Province

THE airfield at Melton Mowbray is within two and a half miles of the town. It is about 300 feet above sea level, and stands out above most of the surrounding country, particularly the Wreake valley which runs in a south-westerly direction from Melton towards Leicester. The total area of the airfield (excluding numerous buildings of various types which were used as living-quarters, etc.) is approximately 500 acres. Of this, about 150 acres are taken up by concrete runways and dispersal points, leaving available for agricultural use about 350 acres. The site was visited by members of the Air Ministry and the Agricultural Executive Committee prior to the transfer of the airfield to agricultural use. This visit was made on a day early in February, 1946, and the bleak, cold wind that swept over it served as a stark reminder of the absence of hedges, trees and other windbreaks. At this time it was agreed to transfer 200 acres for agricultural use, and one of the four hangers was allocated as the only building to be used in connection with farming operations.

During the process of constructing the airfield, some houses and farm buildings were demolished and a main road running almost diagonally over the area was obliterated. Trees, hedges, fences and dykes were levelled by bulldozers and other soil-levelling machines. This resulted in a considerable movement of top soil in some parts, leaving the subsoil exposed, and in other areas there were innumerable obstructions buried at varying depths, many near the surface.

Fences around the boundary consisted of five strands of plain wire. In most places this was reasonably stock-proof as far as cattle were concerned, but not too sound against sheep. There were a few "convenient gaps" which provided easy access for straying cattle and sheep from adjoining land.

At the time the land was taken over the herbage was unproductive—consisting mainly of bent with a sprinkling of wild white clover. Some areas outside the perimeter were overrun with perennial weeds, including docks and thistles, which had flourished for years unheeded, if not unseen.

The soil type is mainly drift boulder clay overlying lower lias. Analysis of the soil showed that the chief deficiency was phosphate. Lime and potash were reasonably adequate. The subsoil areas were very short of nitrogen and humus.

The responsibility for farming the airfield was left to the District Committee of the A.E.C., and because of the many problems, it was decided in the first instance to fallow the whole area available and sow it with wheat for the 1947 harvest.

Of the problems with which the Committee had to contend, one was the lack of adequate drainage. The existing system was intended to drain the

runways and perimeter tracks rather than the land, and consisted chiefly of mole drainage with tiled mains. This resulted in a progressive deterioration in the soil drainage as years elapsed, and deeper cultivations were being carried out. An extensive tile drainage system will soon be required if the area is to be kept under cultivation. It may, however, be possible to mole drain while the land is under grass, since the soil type and slope are suitable. The only water available was a piped supply from the river and this was limited to one point of the airfield. Any possibility of extending it was ruled out as being too costly before some long-term policy had been established.

Labour was another problem. In the first year the fallowing was done by the Machinery Department of the A.E.C., but in the absence of suitable living accommodation, it was extremely difficult to get anyone to supervise the day-to-day working. Ultimately we were fortunate to obtain the services of a very reliable and painstaking Irishman who came to live with his family in one of the Nissen huts which was provided with electric light, water supply and sanitation.

Approximately 50 acres of the area was a derelict bomb store, covered with mounds and intersected by a number of roads. In 1946 this area was considered to be suitable only for afforestation. It took a considerable labour force (P.O.W.) to cut down the weeds, and the high mounds resembled the "hill and dale" which results from deep ironstone workings. The soil on this area was lighter than the remainder and slightly acid.

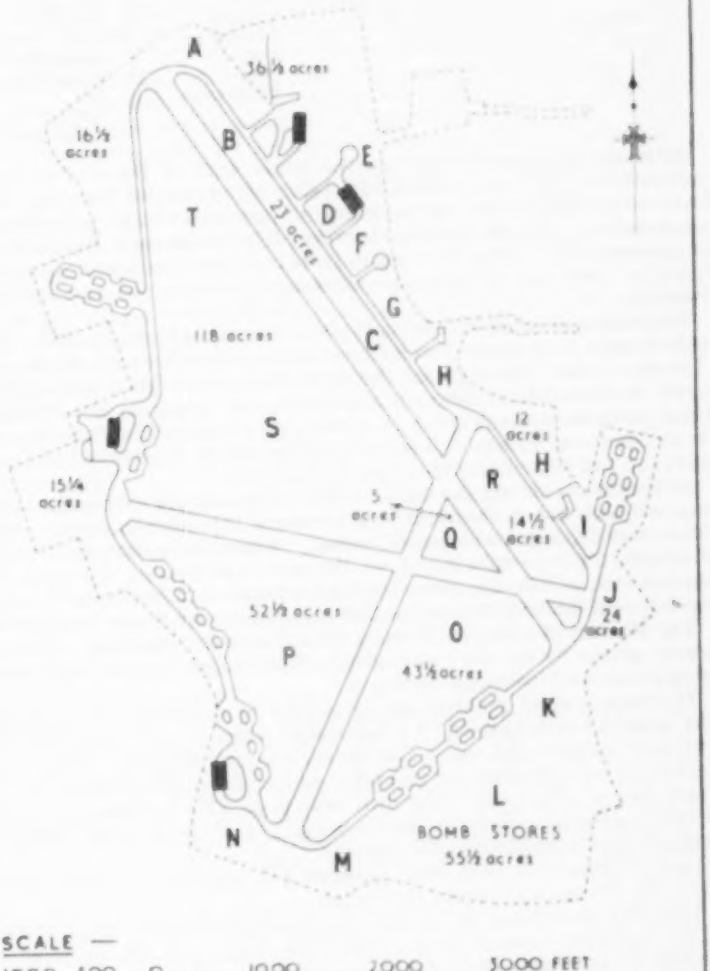
In 1947 the labour available for the unprofitable work of cutting weeds was very limited and it was decided to level the whole area with a bulldozer. This was completed in a week and the area fallowed and limed with 3 tons ground limestone per acre during the summer. It was then combine drilled with Jubilégem wheat and 3 cwt. superphosphate per acre. The wheat came along very well and was then undersown to a long ley with 8 lb. S.48 timothy, 7 lb. S.23 ryegrass and 2 lb. S.100 per acre. The resulting ley was very good. At the same time another area which was mainly subsoil was undersown with a two-year ley.

Four Years' Operations Cultivations were started on 200 acres on May 13, 1946. The weather was favourable and the whole area was ploughed three times. Some parts were ploughed four times, and in a few instances, on rough areas, an initial discing with heavy discs and tracklaying tractors was given. Much of the area had been kept well grazed during the spring. When cultivations began about fifty head of stray cattle and numerous sheep were grazing on the land, so that there was no particular difficulty in burying the herbage with the two- or three-furrow semi-digger ploughs and wheel tractors. The average depth of the first ploughing was about 6 inches, and miles of wires, boulders and stones, and hidden manhole covers were turned up, and a fair amount of damage and breakages to ploughs resulted. Electric cables had been laid under the surface near the main runways, so that we had to leave a grass headland around the main blocks of land. In later years this grass headland was to provide a cut of "meadow" hay.

It was decided to farm the area on a modified four-course rotation. The land inside the perimeter track, approximately 250 acres, can conveniently be divided into five equal areas. The land outside the perimeter track consists of plots which vary widely in size, and for this and other reasons it was not possible to follow any strict rotation. The tendency has been to introduce a wider variety of crops as time went on and to increase the length of the rotation with leys which may remain down for two, three or more

MELTON MOWBRAY AERODROME

PLAN OF AIRFIELD SHOWING MAIN AREAS



years. Yields have been consistent but not spectacular; wheat at an average of 5·6 quarters and potatoes 7·8 tons per acre. The cropping since 1946 is shown below:

1946	*acres*	1947	*acres*	1948	*acres*	1949	*acres*	1950	*acres*
Fallow	200	Wheat	200	Wheat	160	Wheat	95	Wheat	100
		Flax	25	Potatoes	60	Potatoes	50	Potatoes	50
		Fallow	25	Barley	50	Barley	20	Barley	10
				Mx. corn	50	Mx. corn	53	Oats	30
				Peas	20	Beans	12	Mx. corn	20
				Fallow	8	Linseed	10	Beans	10
				Kale	7	Mangolds	5	Peas	15
						Ley	50	Mangolds	5
						Seeds	50	Silage crops	15
						Silage crops	10	Ley	50
								Seeds	50
								Other uses	25

After the first year's cropping the whole area of the airfield became available for cultivation. The District Committee decided that steps should be taken to bring stock into the system of farming to build up fertility. It was hoped to yard cattle during the winter to produce muck for the 50 acres of potatoes which we had planned to grow each year, but it was not until the spring of 1949 that arrangements were completed for the introduction of livestock.

The first lot of cattle were brought on to the airfield in April, 1949. These were allowed to graze the bomb stores area and the aftermath of the seeds. (The bomb stores area grazed the equivalent of one beast per acre from April to November, 1949, when grass was so scarce in the Midlands.) These cattle were made up of 25 calving heifers and 35 other young stock (1- to 2-year-old stores). The heifers were mainly Shorthorn and Lincoln Reds and had been mated to a Lincoln Red bull.

As the heifers calved, the more "milky" of them were sold in the auction ring and their calves "twinned" on to one of the other mothers. All the calves were dehorned with caustic potash. Except for a short spell on seeds aftermath, these animals stayed on the bomb stores area throughout the summer and, in fact, the calves were not weaned until November 7, since it was not until this date that we finished preparations for winter housing them.

The 50 acres of seeds were mown for hay and the aftermath, electrically fenced, grazed by the cows and calves. Some rough shelters were erected, using posts and brushwood on top.

The water supply problem was overcome by adapting a W.D. bowser. The bowser was connected to a galvanized water trough which was fitted with a low pressure ball tap. This system was most effective. When empty the bowser was disconnected and taken to the nearest standpipe with a tap, which was a mile away. The men were soon able to determine the rate of flow required to fill the bowser overnight, so that the water supply was ready to take to the stock in the morning.

Large Nissen huts have been modified and supplied with piped water to house the young stock during the winter.

The chief advantages of farming an area of this kind are: (1) accessibility of the land (the runways are a tremendous asset); (2) the presence of a number of buildings which can be converted or used for various purposes; and (3) the large tracts of land facilitate the use of machinery.

The farming of this land has been very interesting and instructive, not only to the Advisory Officers concerned, but also to many farmers, who make frequent visits to the old airfield.

CONDENSED FISH SOLUBLES IN POULTRY AND PIG FOODS

R. COLES, M.Sc. (Agric.), M.Sc. (Econ.), B.A., Ph.D.
National Agricultural Advisory Service,
and A. R. PRESTON,
Associated Grit Companies' Experimental Farm, Oxford

THE nutrition chemist has long recognized that protein derived from animal sources has a higher feeding value than vegetable proteins for certain classes of farm livestock—namely, the non-herbivorous, simple-stomached animals, which include pigs and poultry. Even today it is common practice to assess proteins on the scale of their biological values, in which animal proteins rank above those of vegetable origin.

In attempting to account for this general difference in biological values, early workers stressed as the limiting factor, the presence or absence of certain amino-acids in the proteins from different sources. While it is true that animal protein is richer in certain amino-acids, such as lysine and leucine, it is equally true that suitable mixtures of vegetable proteins, which provide all the amino-acids found in a mixture of animal and vegetable proteins, will not give as good results when fed to pigs or poultry. The animal protein possesses some factor or factors,* which vegetable protein lacks. It is now generally held that this is of the vitamin type and it is commonly alluded to as the "animal protein factor" (A.P.F.), and accepted as a substance which improves the utilization of protein. When small amounts of substances rich in animal protein are included in a ration for pigs or poultry in which the balanced protein is otherwise of vegetable origin, the diet contains enough A.P.F. to ensure the full utilization of all the available protein.

The facts outlined above support the poultry-keeper's contention that fishmeal or other animal protein leads to improved growth and production in his flock. The frequent failure of many poultry flocks on arable farms to show a production performance equal to that of specialists' birds may, in part, be attributed to the latter's reliance on animal protein. It will be obvious that the identification, production and supply of A.P.F. would be of the greatest importance in those livestock industries where animal protein is essential on account of its high biological value.

An Unidentified Factor A short while ago vitamin B_{12} was isolated* from animal protein by Ott and others[1]. At first it was hailed as the animal protein factor. Further work showed that B_{12} was no doubt part of what must now be regarded as a vitamin complex, but was certainly not the whole of that factor. Lindstrom and his colleagues[2] showed that a big improvement in hatchability followed from the addition of B_{12} concentrate to a ration deficient in animal protein; but the fact that further improvement resulted when B_{12} was replaced by herring meal, indicated that the A.P.F. carried some factor additional to B_{12}.

Varying results in hatchability and rate of growth were obtained from some of the earlier experimental work on the response to B_{12}. No allowance was made for the fact, discovered later, that the diet of the parent stock

*It is not yet known whether the unidentified portion consists of one or more factors. References to the unidentified factor throughout this article should therefore be read with this in mind.

influenced the response of the chick, and that the latter received reserves of B_{12} from the hen when she was being fed animal protein carrying B_{12} in her ration. Absence of the vitamin in the diet of the parent stock led to low hatchability, and poor growth and feathering. A dramatic recovery could be effected by the injection of vitamin B_{12} into the incubating egg at the eighteenth hour.

By the work of Bird and his associates, it seems clearly established that B_{12} is essential for good hatchability and growth over the first few weeks of the chick's life. Several workers have now shown that further improvement is achieved from the addition of the remaining unidentified portion of the animal protein factor. Heuser and his colleagues at Cornell have demonstrated that this unidentified factor is of importance for sound growth and development *after* eight weeks.

The general conclusions to be reached from the experiments so far carried out is that A.P.F. is a vitamin complex which includes B_{12} and some other so far unidentified factor. Vitamin B_{12} appears to be essential for good hatchability and for sound growth over the first six weeks or so of the chick's life. Additional improvement—but to a lesser degree—is achieved through the presence of the unidentified factor of the A.P.F., and the latter is essential for continued good growth after the initial period. During the later stages B_{12} does not seem to be so important and may not be of outstanding importance for egg production; the requirement in any case appears to be lower than that needed for good hatchability. It seems possible, however, that the unidentified factor is not only of greater importance during the later stages of growth but that it is also essential for good egg production. This last contention admittedly rests largely on the observations of many practising poultry-keepers that a substantial improvement in egg production results from the addition of animal protein to a poultry ration containing only vegetable protein. In recent years there appears to have been no comparative experimental work to support this widely held belief, although work recently concluded at the University of Nottingham demonstrates that only moderate egg production is secured when no animal protein is included in the bird's diet. If, therefore, it can be definitely shown that B_{12} is of relatively minor importance for egg production—and this opinion seems questionable—then the increased egg production following the addition of animal protein to an all-vegetable diet must presumably be due to the influence of the unidentified factor of the A.P.F. if the amino-acid balance is satisfactory.

There is, as yet, no information about the relation of the unidentified factor and B_{12} in animal proteins from varying sources, nor as to whether both are present in all forms of animal protein, but it seems logical to assume that they are, although the ratio may vary.

Condensed Fish Solubles as a Source of A.P.F. Since it is the animal protein factor which gives to protein from animal sources (fishmeal, meat meal, etc.) that observed advantage over vegetable protein, there has been diligent search for some reasonably easily available substance which carries the A.P.F. The value of such a material to British farmers who are having to rely largely on home-grown cereals and pulses for pig and poultry rations and are faced with a scarcity of animal protein, will be obvious. One such substance, which is now extensively used in U.S.A., is stickwater, which is the liquor pressed out during the manufacture of fishmeal.

Stickwater will normally contain water-soluble material derived from the fish, and its nature will therefore vary according to the species of fish used in the manufacture of the meal. The method of processing the meal,

and subsequently the stickwater, will also effect their quality; certain manufacturing methods may destroy or impair the value of the nutrients contained in the meal *and* the stickwater, but, with any particular type of fish handled by an established process, it seems likely that the products would show only small variations in quality.

Stickwater is condensed to a viscous liquid containing 50 per cent solids. A typical analysis of condensed fish solubles produced in the U.S.A. from a pilchard type of fish is as follows:

Protein	32 per cent
Calcium (Ca)	0.87 per cent
Phosphorus (P)	0.85 per cent
Riboflavin	8–9 mg. per lb.
Choline	1500–1800 mg. per lb.
Niacin	150 mg. per lb.
B_{12}	1.4 mg. per grm.

Other vitamins were also present. If we assume that the unidentified factor in A.P.F. is also associated with B_{12}, we can assume that A.P.F. is also present. This opinion is strongly endorsed by the experiments carried out by Sunde and his colleagues(3). They demonstrated that condensed fish solubles (C.F.S.) carried the unidentified factor, since improved growth was observed when B_{12} in an all vegetable diet was replaced by C.F.S. A similar improvement was obtained when liver products were used in place of C.F.S. It is interesting to note that Sunde refers to other trials in which the growth response with fishmeal was rather lower than that obtained from C.F.S. There appears no way of assaying A.P.F. quantitatively; only biological estimations can so far be carried out.

It has been estimated by Stokstad and his colleagues(4) that chicks require 15 microgrammes of B_{12} per kg. of food (i.e., approximately 750 microgrammes per cwt.). A good sample of C.F.S. contains 1 to 1.5 microgrammes per gramme, and therefore 5 lb. of C.F.S., with this B_{12} content, added to 1 cwt. of mash, should supply betwen 2,270 and 3,400 microgrammes of B_{12} per cwt., or between three and four times the minimum requirement. From Sunde's work(3) we must assume that sufficient of the unidentified factor of the A.P.F. is also present.

It is, therefore, logically argued that if C.F.S. is added in small quantities to a ration correctly supplied with carbohydrates, protein of vegetable origin and minerals, the mash should be equal in its biological value to a ration of similar chemical composition where much of the protein is of animal origin.

Two Experiments in Oxfordshire No formal experimental work appears to have been carried out to investigate the value of C.F.S. in supplying A.P.F. in a ration for commercial egg production, although it is now common practice in western U.S.A. to add C.F.S., together with dried lucerne meal, to poultry foods lacking any other form of animal protein. It is held that the production rates equal those achieved when fishmeal or some other form of animal protein is included in the diet. This would seem to be the expected result consequent on the addition of the animal protein factor. In an attempt to verify further the value of C.F.S. as a supplier of A.P.F. in egg-laying flocks and with growing pigs, two pilot experiments were started at the Associated Grit Companies' Experimental farm in Oxfordshire.

Poultry In the case of the poultry, families of full sisters were divided at random amongst three batteries, each of sixty laying cages—the age of the birds having an overall difference of four weeks. The batteries have a controlled "day" of 13 hours. For the first three weeks, at a period when the

birds were coming into full lay, all batteries were fed *ad lib.* on a normal battery ration (Ration A) containing 10 per cent animal protein-rich foods. The three batteries showed no significant difference in egg production. For the following five months one battery continued with the normal Ration A, but the other two batteries were supplied with rations from which all animal protein was excluded, with the exception of a small amount of C.F.S. The details of the three rations are shown in Table I.

Table 1

Ration A	*parts*	*Ration B*	*parts*	*Ration C*	*parts*
Coarse ground oats	34	Ground oats	20	Peas	25
Ground wheat	40	Ground wheat	41½	Ground oats	15
Dried grass	12	Dried grass	7½	Ground wheat	36½
Fishmeal	5	Weatings bran	10	Salt	½
Meat and bone meal	3	S. seed meal	2½	C.L.O.	1
Ground chalk	1½	Dec. groundnut	2½	Ground chalk	1½
Salt	½	Ground chalk	2	Dried grass	10
C.L.O.	1	S. bone flour	2½	S. bone flour	3
Weatings bran	2½	Linseed	2½	C.F.S.	7½
S. bone flour	½	Salt	½		100
	100	C.L.O.	1		
		C.F.S.	7½		
			100		

It will be seen that Ration B is in the nature of a commercial laying mash—apart from the absence of fishmeal—while Ration C is made up from home-grown cereals, peas and dried grass and purchased minerals. In both Rations B and C, 7½ per cent of the ration was composed of C.F.S., which, after three months, was reduced to 5 per cent and the vegetable protein adjusted so that the three rations continued with approximately identical quantities of total proteins, carbohydrates, minerals, etc.

The results are shown in Table 2 from which it can be seen that the production of the 60 birds in the battery fed on Ration C exceeded that of either of the other batteries by approximately 300 eggs. No significant difference was observed between the remaining two batteries. Production in all batteries has been of the order of 60–70 per cent—a figure not normally achieved when animal protein is absent from the diet.

Table 2

Egg output on Ration A for control period of 19 days	200 *Ration A*	202 *Ration B*	209 *Ration C*
Egg output on:			
Nov.	931	969	970
Dec.	1,247	1,238	1,198
Jan.	1,059	1,043	1,162
Feb.	881	916*	995*
Mar.	1,137	1,112*	1,240*
	5,255	5,278	5,563

* C.F.S. reduced to 5 per cent and vegetable protein adjusted.

The reduction in the quantity of C.F.S. resulted in no apparent change in the relative output of eggs between the three groups, and a further reduction of the C.F.S. by 2½ per cent has so far produced no change. An additional battery in which the pea meal in Ration C has been reduced from 25 per cent to 15 per cent has shown a production comparing satisfactorily with that from the birds fed on Ration C.

Pigs In the experiment with pigs, three families of four animals aged six weeks were divided into two groups. One group was fed on a normal commercial growers' mash, containing 9½ per cent animal protein, and the second group on a mash in which the only protein of animal origin was C.F.S. (Table 3).

Table 3

	parts		*parts*
Weatings	17½	Weatings	10
Linseed	5	Linseed	10
Dec. groundnut	7	Dec. groundnut	10
Ground chalk	1	Ground Chalk	1½
Barley meal	54	Barley Meal	33
C.L.O.	½	Ground wheat	18
Fishmeal	7	C.L.O.	½
Dried grass	5	Dried grass	7
Meat and bone meal	2½	Salt	½
Salt	½	C.F.S.	7½
		S. bone flour	2
	100		100

In both instances the chemical composition of the mashes was approximately identical. Again the C.F.S. group slightly exceeded the control group in that at killing stage at 7½ months, the C.F.S. group averaged 10½ score and the control group averaged 8 lb. lighter. An examination of the carcasses of the two groups of Wessex crosses revealed no material differences, although the skin of the C.F.S. group appeared with pale cinnamon coloration.

Both pilot experiments have so far borne out the views of American poultrymen that a small amount of C.F.S. added to a diet in which the protein is of vegetable origin supplies the A.P.F., and the ration proves as effective as a diet containing fishmeal or other form of animal protein. Further experiments using home-grown foods with and without the addition of C.F.S. are projected; solubles produced by both fish and whales will be used.

References

1. Activity of Crystalline B_{12} for Chick Growth. Ott, W. H., Rickes, E. L. and Wood, T. R. *J. biol. Chem.* 1948, **174**, 1047–8.
2. Activity of a Vitamin B_{12} Concentrate for Chick Growth and Hatchability. Lindstrom, R. C., Moore, P. R., Petersen, C. F. and Weise, A. C. *Idaho Agric. Ext. Sta.* Paper 292 (1949).
3. An Unidentified Factor required by Chicks fed Practical Rations. Sunde, M. L., Cravens, W. W., Elvehjem, C. A. and Halpin, J. G. *Poult. Sci.* 1950, **29**, 204–7.
4. The Multiple Nature of the Animal Protein Factor. Stokstad, E. L. R., Jukes, T. H., Pierce, J., Page, Jr. A. C. and Franklin, A. L. *J. biol. Chem.* 1949, **180**, 647–54.
5. Studies on All-Vegetable Protein Rations. Emerson, R., Houston, J., Thayer, R. H. and MacVicar, R. *Poult. Sci.*, 1949, **28**, 431–5.

CRUDE FIBRE IN FEEDINGSTUFF ANALYSIS

BRYNMOR THOMAS, B.A., and D. G. ARMSTRONG, B.Sc.
King's College, Newcastle-upon-Tyne

FOR some years there has been widespread discussion, in this and other English-speaking countries, on the usefulness of the "crude fibre" determination in feedingstuff analysis. The consensus of opinion appears to be that the resulting value is misleading, in that the fraction which it represents is not a chemical entity and may vary widely in constitution as between material and material, and between feed and faeces. Thus Norman(1) has said: "It would be an important advance if the determination of crude fibre and its use in expressing composition were abandoned as inadequate, unreliable and misleading." This worker has suggested that the determination of lignin would be of more value, but, in general, criticism of the present procedure has been largely only destructive.

In the First and Second Schedules of the Fertilisers and Feeding Stuffs Act of 1926, it is required that particulars of the crude fibre content shall be included in the Statutory Statements relating to a considerable number of feedingstuffs. As the writers understand it, one of the major purposes of this requirement is to afford a rough and ready measure of the digestibility of the feedingstuff in question. It is proposed in this article to review existing evidence for and against the continued use of the crude fibre figure, and to consider whether any amendment is possible in the light of our present knowledge of the make-up of the carbohydrate fraction.

Crude Fibre or Lignin as Measure of Digestibility? In general it is true to say that there is a direct relationship between crude fibre and lignin content, and an inverse relationship between lignin and the digestibility of the organic matter. McKeekan(2), who examined the data relative to fifty samples (including silages, succulents, roughages and concentrates), selected at random from a wide range of feedingstuffs analysed by Woodman(3), obtained a highly significant negative correlation between fibre content and digestibility (−0.944). Exactly the same correlation coefficient for these two variables was obtained by Lancaster(4) from seventeen widely different feeds. Phillips and Loughlin(5) found correlation coefficients of −0.842 and −0.784 respectively for crude fibre and dry matter digestibility, as a result of their examination of ten timothy hays and seven lucerne hays; both of these values are significant at the 5 per cent level. That such a correlation does not always exist has been shown by Crampton(6) and Crampton and Forshaw(7), in studies of the nutritive value of pasture grass. Furthermore, Thomas and Ibbotson(8), in their investigations into the composition of *Molinia coerulea* (flying bent), found that as the season advanced the digestibility of the organic matter fell steadily, while there was no corresponding increase in the crude fibre content; the correlation coefficient (−0.460) was well below the required level of significance. It would appear, therefore, that the crude fibre content cannot be regarded as an infallible criterion of digestibility. It should be added that the procedure for the determination of crude fibre specified in the Fertiliser and Feeding Stuffs Regulations is rather widely varied in practice. Such variation detracts from the usefulness of the results.

As already indicated, the replacement of the crude fibre determination by that of lignin has been suggested, and there is evidence that the latter would provide a more reliable measure of digestibility. Lancaster(4), Thomas(9) and Phillips and Loughlin(5) have established correlation coefficients for lignin content and digestibility of organic matter of −0.978, −0.980, and of −0.954 and −0.939 respectively. All of these coefficients are highly signi-

ficant. The authors are unaware of any failure to obtain significant correlation between the two variables in question.

It thus appears that lignin is a more satisfactory criterion of digestibility than is crude fibre, and that it could with advantage replace the latter for the purpose of the Act and indeed in any statement of analysis. It is, nevertheless, doubtful whether such an immediate change would be expedient. The existence of a large fraction, labelled "nitrogen-free extractives," and determined only by difference, has always been regarded as an unsatisfactory feature of the Henneberg and Stohmann scheme of analysis, and the substitution of lignin for crude fibre would substantially increase the size of this fraction. Moreover, the assumption that all constituents of the nitrogen-free extractives have the same fat-producing capacity would seem to be entirely unjustified; indeed, the findings of Kellner[10] indicated that they have not. It is true that Crampton and Maynard[11] have proposed that the cellulose content should be determined in addition to lignin. There is much to be said for such a proposal; the determination of cellulose is relatively straightforward and its fat-producing capacity is known. It seems to us, however, that if it can be established that the various carbohydrate components have differing fat-producing capacities, fractionation should be carried rather further. In such a case both hemi-celluloses and sugars might be accounted for in addition to cellulose. Further research into the make-up of the carbohydrate fraction, and the nutritive value of its components, would seem to be urgently necessary. It is thus possible that an immediate change in the provisions of the Act might have to be followed by another at no very distant date. Under the circumstances the replacement of crude fibre determination by that of lignin would perhaps be better deferred until such time as the aforementioned information is available.

It should be pointed out that the substitution of lignin for crude fibre in feedingstuff analysis would involve the re-calculation of starch equivalents. As the percentage of digestible lignin in any feedingstuff would certainly be small, then whatever value is attached to it, the calculated fat production of the carbohydrates (prior to correction by application of the "V" number) would be very little affected, provided all the carbohydrate components had been found to have the same fat-producing capacity as before, namely, 0.25 lb. per lb.; as already indicated there is no certainty that such would prove to be the case. The correction formerly based (in the case of coarse fodders at least) on fibre content might be appreciably different, since it would have to be re-determined on the basis of lignin content.

There may be no general adoption in the immediate future of a revision of the present scheme of analysis, such as that suggested above, but it is obviously desirable that the research worker engaged in animal nutrition should know more about the carbohydrate fraction of the feedingstuffs which he handles. The immediate adoption, for experimental work, of some scheme of fractionation such as that proposed by Crampton and Maynard and already referred to, would be a step in the right direction.

References

1. Norman, A. G. *J. Amer. Soc. of Agron.*, 1939, **31**, 751.
2. McKeekan, C. P. *New Zealand J. Sci. Tech.*, 1943, **25**, A. 152.
3. Woodman, H. E. *M.A.F. Bull. No. 48*, "*Rations for Livestock*."
4. Lancaster, R. L. *New Zealand J. Sci. Tech.*, 1943, **25**, A. 137.
5. Phillips, M. and Loughlin, T. G. *J. agric. Res.*, 1949, **78**, 389.
6. Crampton, E. W. *Sci. Agric.*, 1939, **19**, 345.
7. Crampton, E. W. and Forshaw, R. *J. Nut.*, 1940, **19**, 161.
8. Thomas, B. and Ibbotson, C. F. *J. agric. Sci.*, 1947, **37**, 58.
9. Thomas, B. Unpublished data.
10. Kellner, O. "*The Scientific Feeding of Animals*," p. 53.
11. Crampton, E. W. and Maynard, L. A. *J. Nut.*, 1938, **15**, 383.

POTATO ROOT EELWORM IN JERSEY

T. Small, D.Sc., A.R.C.S., E. Dunn, B.Sc.,* and G. E. Thomas, B.Sc.

Experimental Station, Jersey

In view of the importance of the potato and outdoor tomato crops in Jersey, the discovery on the Island of a pest which attacks both these crops must be regarded as a serious matter, and especially so when experience in other countries has shown that the pest causes much loss and is difficult to control. The first outbreak of potato root eelworm (*H. rostochiensis*) in Jersey was found on early potatoes in a private garden in 1938, the infestation being severe and probably of several years standing. A second case was reported in August, 1938, in a field of outdoor tomatoes. These discoveries were reported in the local press, and farmers were advised of the precautions necessary to prevent the introduction and spread of the eelworm on their farms. In both instances observations indicated that under certain conditions early potatoes and outdoor tomatoes in Jersey may suffer seriously from attacks of potato root eelworm. This has been amply confirmed in more recent years; in a few cases early potatoes have yielded less than the weight of seed planted, but up to the present the most widespread losses have occurred on tomatoes where, in some fields, yields have been reduced from an average of 15 tons per acre to less than 2 tons.

Legislation Imported Potatoes. In Jersey almost the whole of the early potato acreage is planted with the variety International Kidney. For many decades farmers have saved their own seed of this favourite variety, and relatively little seed of other early or of late varieties has been imported. To minimize the risk of importing potato root eelworm on seed potatoes, legislation was introduced in 1935 requiring all potatoes entering the Island to be certified as being free from the eelworm; the certificate is based on

(*a*) Examination of the land in which the potatoes are grown, or

(*b*) Examination of the soil obtained from the potatoes on riddling, or

(*c*) Examination of the roots of the growing crop after the first July in any year.

As a further precaution, samples of soil taken from imported seed or ware potatoes are examined. In this way, several infested consignments have been found, which indicates one probable way in which the pest was originally introduced into the Island. Infested consignments of imported seed potatoes may not be sold for planting and, because potatoes bought for consumption are sometimes used as seed, infested potatoes are labelled (each bag) "Eelworm infested: these potatoes must not be planted."

Prevention of spread within the Island. Legislation exists giving wide powers to the Jersey States' Committee of Agriculture to prevent the introduction into, and the propagation within, the Island of plant pests and diseases. Following the finding of the eelworm outbreaks in 1938, the growers were directed to grass down the infested areas. But before enacting legislation to deal specifically with the parasite, it was decided, after consultation with the late Sir John C. F. Fryer, to make an all-Island survey to determine the extent of the infestation to provide data on which legislation could be based. If, for example, the survey showed that the pest was

*Now at the Ministry of Agriculture and Fisheries Plant Pathology Laboratory, Harpenden

confined to a few areas, then drastic action might be considered advisable, but this would not be possible if the malady were widespread. The survey was started in 1939, when twelve men were trained to examine crops and soil and afterwards divided into three teams, each team being allocated a certain area for inspection. Unfortunately the scheme had to be abandoned in its early stages owing to the occupation of the Islands in June, 1940.

During the war the land under potatoes and tomatoes was greatly reduced, thus giving the soil a much needed rest from these crops. Consequently in the two to three seasons immediately after the war, excellent crops of potatoes and tomatoes were grown in fields known to be heavily infested before the war. This, together with the many pressing problems of the immediate post-war years (including numerous outbreaks of the Colorado beetle*), tended to limit the time devoted to the investigations. In these years growers were encouraged to report suspicious cases, and these were examined whenever time allowed. Confirmed outbreaks were recorded and mapped, and it soon became evident that the pest was widespread in some areas. Hence it was decided not to introduce legislation at present but to rely on propaganda to check the spread of eelworm within the Island.

Spread of Pest Besides the usual well-known means of spread by seed potatoes, farm implements, root crops, worker's boots, etc., the parasite is carried in other ways. The millions of hollow bamboo canes used to support outdoor-grown tomatoes may contain the cysts. In one test 200 cysts were found on 50 canes taken from an infested field; as many as 15,000 canes are used per acre, and many thousands of used canes are sold privately or at farm sales each year. Another dangerous practice is to spread potato haulms, with roots attached, on grassland. In addition, tomato haulms (including the roots) and loam from potato and tomato fields are often added to composts for raising tomato seedlings, millions of which are sold annually. These composts are not always sterilized, and thus there is a real risk of distributing the pest by this means.

Growers have been informed of the many ways in which eelworm may be carried from infested to clean land—by articles published in the local press, films, lectures, personal interviews, and by a series of leaflets posted to every farmer in the Island.

The Infested Areas Although the pre-war systematic survey has not been continued, more than 2,500 soil samples from all parts of the Island are brought or sent in annually by farmers to the Experimental Station. These are usually tested for lime and manuring requirements, but where eelworm is suspected an examination is made. By this means many new outbreaks have come to light. As yet, however, almost all the known infestation is in certain coastal areas (see map on p. 214), which, unfortunately, include some of Jersey's most valuable land, where early potatoes, followed by tomatoes in the same season, have been grown for many consecutive years. Before the war one field was known to have been cropped continuously in potatoes for more than ninety years, and in thirty of those

* Colorado Beetle in Jersey : 1939-46, *Agriculture*, **53**, 450-3.
1947, *Agriculture*, **54**, 569-74.
1948, *Agriculture*, **56**, 115-9.

years tomatoes had been grown as a second crop. On most of these coastal areas little or no crop rotation is practised, thus offering very favourable conditions for the rapid multiplication of the parasite. If rotation should become necessary in such areas, a considerable fall in land values would follow.

Infestation by Potato Root Eelworm in Jersey.

In the remainder of the Island, which includes by far the greater part, cattle are kept, some rotation is carried out, and relatively few infested areas are known. One factor which has to be constantly borne in mind in Jersey in considering crop rotation is the enormous numbers of "volunteer" potato plants which develop early in autumn (after the earlies have been lifted) and in subsequent years. These must be destroyed if the full advantages of rotations are to be obtained.

Eradication of eelworm is scarcely practicable now; the aim must be to localize the outbreaks and to reduce the losses in the affected areas. With the latter purpose in view, trials with the soil fumigant D-D were started in the autumn of 1946.

D-D Trials In the field investigations, consideration was given to crop yield, to effect on plant growth and to changes in eelworm population. The latter is important because any treatment which results in a larger yield but with an increase in eelworm population, defeats its purpose.

CONDITIONS AND COST OF TREATMENT. Injection was carried out in most cases in March to April, using proprietary hand-injector pumps, in soil previously cultivated to a fine tilth, having a medium soil moisture and a temperature around 50° F. The D-D was injected 6 inches deep at the rate of 5 c.c. per

pump and at intervals of 1 foot. The holes were immediately closed by a second man, using the heel of his boot or a rammer. An interval of at least one month elapsed before planting; seven days prior to planting the soil was opened up by harrowing. In 1949 the estimated cost, using one hand injector, two men, and 540 lb. of D-D, was £48 per acre.

POTATOES. In these experiments, soil injection gave greatly increased yields but without any corresponding reduction of the eelworm population. Tainting of produce occurred where only 3 months elapsed between treatment and planting, but not where a 5-month interval was given. Because of the unsatisfactory results obtained in Jersey, and of the experience in the English trials*, together with the risk of taint, investigations have been discontinued for the present, and work is being restricted to tomatoes, where the results have been more promising.

TOMATOES. In 1948 it was shown that the treatment of severely infested land resulted in a considerable improvement in crop growth and yield. In 1949 soil injection previous to cropping with outdoor tomatoes was carried out in ten fields on six farms and a total of approximately ten acres was treated. Eelworm attack in these areas had been checking crop growth and severely reducing the yields. The total cyst population was more than 100 cysts per 100 grams of air-dry soil in the worst patches. In all cases, injection resulted in a uniformly great improvement in crop growth and general appearance, and the yields equalled or surpassed those from plants growing under similar, but eelworm-free, conditions. A trial on soil carrying a medium eelworm infestation demonstrated that the total yield on treated plots averaged a 60 per cent increase over untreated plots. Since the produce from eelworm-attacked plants is poor in quality, the increase in marketable fruit is considerably higher than 60 per cent. The most interesting and promising result is that, so far, there has been practically no build-up of cysts at the end of the cropping period, in spite of improved root growth. Further evidence is required to establish this point, and investigations are in progress to determine the larva per gram count before and after cropping. Additional evidence which points to no excessive build-up of eelworm is that in one trial a fair crop was grown in 1949 in soil treated and cropped in 1948 but left untreated in 1949. Soil treated two years in succession resulted in a more sturdy plant than that treated once only in the year of cropping.

The results so far obtained suggest that injection of D-D is amply justified on heavily-infested valuable land. Land which is unproductive as far as tomatoes are concerned, due to infestation, has been brought back into full production for one cropping period without increasing the eelworm population. Small areas in fields can be treated by hand as labour costs relative to the cost of material are low, but in larger areas of one or more acres where eelworm infestation is general, a method of machine application must be sought in order to take full advantage of suitable soil and weather conditions.

* Peters, B. G. *Agriculture*, 1949, **55**, 493-8.

PARSNIP CANKER

Summary of a Report on Investigations carried out during 1946–48 at the request of the Horticultural Group of the Agricultural Improvement Council.*

D. E. Green, M.Sc., and M. Ann Hewlett, B.Sc.
Royal Horticultural Society, Wisley

THE rotting of the shoulder areas in parsnips in Great Britain first aroused interest in 1916 when, in the Evesham area, it was estimated to cause a loss of 10–50 per cent of the crop. The subject was then studied by Cotton(1) who concluded that it was a physiological disorder depending largely upon weather conditions. In 1922 the trouble was again rather severe and in 1924–25 caused heavy losses, one district in Derbyshire reporting an 80 per cent loss of the late-lifted crop. As a result, some experiments were carried out by Stirrup and Roebuck(2); they also concluded that the trouble was non-parasitic, but that some varieties were more resistant than others. Since then, Parsnip Canker has appeared fairly regularly, severe attacks occurring every few years. It has been examined by various observers (3, 4, 5, 6) in small experiments and has been variously attributed to a fungus (*Phoma* sp.), to eelworm, and to carrot fly attack followed by secondary rotting, the last being the most popular theory.

In 1946, the crop again suffered severely from Canker, and in the course of normal advisory work at Wisley, cases showing losses up to 70 per cent were encountered on some fairly large acreages in Surrey. As a result, some small experiments were started at Wisley in the hope of finding a clue to the cause of the disorder. Meanwhile, the National Farmers' Union, aware of the extensive damage due to Parsnip Canker, were pressing for further research into the trouble. Their request was renewed in 1947 and the Agricultural Improvement Council asked that the Wisley experiments should be extended.

Apart from two or three easily identified conditions, the word "canker" has been used to cover almost any rot or breakdown of tissue seen on the shoulder of parsnips. The first step, therefore, was to classify these conditions and distinguish the one to which the term "canker" should apply. There proved to be at least six distinct conditions, some of them due to well-known pests or diseases:

1. Soft Rot (*Bacterium carotovorum*) causes a very soft, mushy rot which quickly reduces the crown and part or all of the shoulder to a wet, slimy mass, and in general travels down the core first. This rotting is not rare but is so occasional that it can be disregarded.
2. Violet Root Rot, caused by the fungus *Helicobasidium purpureum*, may appear as a purple discoloration enveloping part or all of the root. This fungus disease is well known† and apparently not more common on parsnips than on other root crops, nor in our opinion is it likely to become serious.
3. Slug Injury, due to *Milax* sp., sometimes results in an extensive eating-away of the tissues of the shoulder and may or may not be followed by rotting organisms. It is not common enough to be considered as playing any part in the development of canker.

*Copies of the full report can be obtained free from the Ministry of Agriculture, Advisory Services Branch, Cambridge Terrace, Regent's Park, London, N.W.1.

†See the Ministry's Advisory Leaflet No. 346.

4. Eelworm (*Anguillulina dipsaci*) causes a severe rotting of the shoulder areas of parsnips, with a blackish-brown discoloration and destruction of tissues as described by Walton(⁶). This trouble is still being reported and may possibly be severe where parsnips follow onions, but we do not think it can yet be considered widespread.

5. Carrot Fly (*Psila rosae*) injury is very common indeed, the damage being found on any part of the root. When severe, the affected area can present a very damaged appearance.

6. Canker—a discoloured area, usually on the shoulder of the root, at first superficial and brown to reddish-brown in colour. In many instances the colour changes to blue-black, the canker becoming depressed and often showing considerable rotting of a dry rather than a wet nature until late in the year when wet soil conditions encourage the wet form of rot.

(In addition to the above classifications, there is a special form of shoulder rot caused by a fungus, considered to be a species of *Phoma*, which has been reported on two or three occasions but is not considered to be of any economic importance.)

Although in some instances a mixture of two or more of these conditions may make identification rather difficult, numbers 1 to 5 above are fairly well defined and attention has been focussed on number 6. It is this which we consider the most important and propose to reserve for it the name of "Canker".

Tests with Cultures Although earlier workers(¹,²) assumed that the development of canker was associated with the entrance of micro-organisms through a wound, none of them appears to have attempted isolation of possible pathogens except Cotton, who isolated the *Phoma* sp. already mentioned. Our first isolations from the superficial tissues after surface sterilization gave a very mixed result, yielding such fungi as *Penicillium* sp. and *Fusarium* sp., as well as bacteria and free-living eelworms. Technique was improved by scrubbing the cankers well, sterilizing the tissues and taking cultures from deeper down. In the next 120 cultures, 119 gave bacteria and one remained clean but there was no sign of eelworms or fungi. Many of the cultures appeared to be identical, and twenty were selected for inoculation. These twenty cultures were inoculated into eight varieties of parsnips in July, 1947, using four roots of each variety for each culture, the total number of roots inoculated being 640, the rest of each row serving as controls. The parsnips were lifted at the end of October, when in 95 per cent, the inoculation cuts were still visible but clean, while the remaining 5 per cent, although discoloured, in no way resembled the type of canker being studied. The exceptionally hot, dry weather may have affected the inoculations adversely, but it is interesting to note that a month later control roots which had remained in the plots showed canker. Furthermore, some stocks of the same variety were found to be badly affected while others were clean.

From cultures isolated from cankered roots in the following spring, ten were selected and inoculated into ten roots of each of five varieties in July, 1948 (500 roots treated). In November, 1948, 150 of these roots were lifted but showed little sign of canker, despite the moist weather. The remaining 350 roots lifted in January (5½ months after inoculation) still showed no appreciable signs of canker. These experiments were carried out on a light type of soil, and it may be that its moisture-holding capacity had an important

bearing on the trouble. Any future experiments of this kind should be arranged in a soil that retains ample moisture throughout the season and is preferably sterilized.

What Causes Canker ? Tests to discover whether canker was the result of bacterial infection after a wound were carried out in July, 1948, on five varieties. The method was to remove the soil and injure the shoulder below soil level by:

1. making two or three small cuts with a scalpel;
2. scraping an area half-inch square on the shoulder with the blade of a knife; and
3. bruising a similar area by tapping several times with a small hammer but not breaking the skin.

Five roots of each strain were subjected to each of the three treatments, making a total of 75 roots treated. On lifting in the following January, there was some superficial discoloration but in no case was there anything resembling the true canker appearance.

Throughout the history of Parsnip Canker, certain writers have suggested the primary cause to be cracking of the surface tissues during irregular growth, especially when rain follows a dry period, and this view still finds much support. During this investigation, we have lifted parsnips in light and heavy soils each month, commencing in August, but have found no evidence that parsnips develop cracks while in the ground. Growers and others in the habit of handling parsnips support the opinion that these roots do not commonly show growth cracks, least of all horizontal cracks near the shoulder.

During the course of this investigation when, in 1948 alone, about 24,000 roots were examined and we personally handled over 12,000, our interest was aroused by the fact that cankers were in almost every case horizontal in the early stages and seemed to develop in the small sunken places from which roots had arisen and died back. We feel this point needs critical examination but as yet we have been unable to pursue it. It is, however, interesting to note that we have often cut the most minute discoloured areas in the locality of these tissues and obtained bacteria from the inner cells.

Although earlier writers[1,2] suggested that Parsnip Canker was a non-parasitic disorder, the tendency during the last twenty years has been to associate it with carrot fly injury[4,5], and certainly this is very common in parsnips. With the help of Mr. G. Fox Wilson, the Entomologist at Wisley, a count was obtained of the carrot fly injury on each of the seventeen strains of parsnips on both light and heavy land for the December (1948) and January (1949) liftings from the varietal trial plots at Wisley. In addition, figures for carrot fly attack on the same seventeen strains of parsnips at liftings in November, December and January were received from the N.A.A.S. officers concerned with the trial plots at Staplake Mount, Devonshire. Both the Wisley and Staplake Mount results are shown in Table 1 (p. 219), the figures in each case including all grades of injury whether slight or severe.

It will be seen that at Wisley carrot fly injury was always more severe on the light soil than on the heavy, while the reverse is true of canker to an even more marked degree. That there is little relation between carrot fly injury and canker is evident from the fact that on light soil in December at least three varieties showing 100 per cent carrot fly attack had less than 10 per cent canker attack, while on the heavy soil in January certain varieties showing about 60 per cent carrot fly attack had 100 per cent canker attack. Similar instances can be quoted from the Staplake Mount figures

TABLE 1

COMPARISONS BETWEEN CARROT FLY INJURY AND THE AMOUNT OF CANKER ON DIFFERENT TRIAL PLOTS

(All figures are percentages)

Variety or Strain	Wisley, Surrey								Staplake Mount, Devon					
	December				January				November		December		January	
	Light Soil		Heavy Soil		Light Soil		Heavy Soil							
	Carrot Fly	Canker	Carrot Fly	Canker	Carrot Fly	Canker	Carrot Fly	Canker	Carrot Fly	Canker	Carrot Fly	Canker	Carrot Fly	Canker
1. Lisbonnais A.	100	9	74	85	86	8.3	67	96	100	43	77.5	78.2	66.5	47.5
2. Lisbonnais B.	98	20	91	93	99	24	65	91	100	71.4	90	65	100	50
3. Lisbonnais C.	100	22	87	89.5	98	29.4	76	98	88.5	70	94	95	95	60
4. Lisbonnais D.	100	12.9	88	99.5	97	41.4	74	100	92	75	80	77	93.5	33
5. Lisbonnais E.	95	10.5	79	85.5	98	18.6	65	86	91	55.5	84	57	100	61.5
6. Offenhom A.	100	18	79	84.5	96	13.3	67	100	83	50	50	39	76.5	70.5
7. Offenhom B.	100	13.5	80	96.5	91	6.2	70	100	95	46.1	94	88	100	44
8. Offenham C.	91	22.6	78	97.5	98	13	58	98	82.5	78.5	95.5	40	77.5	50
9. Offenham D.	100	41.3	89	92.1	97	21.9	92	100	90	83.3	82.5	82	87	80
10. Magnum Bonum	100	12.7	70	68.5	94	4.1	70	96	91	33.3	100	85	94	69
11. Marrow Improved	100	9.1	78	90.5	93	6	80	93	100	33.3	78.5	73	86	57
12. Tender and True	100	10	59	65	97	3.8	89	89	75	20	57	80	69	37.5
13. Syston's Inter.	100	13.1	70	95	99	22.4	58	100	86	84.6	91.5	95	95	70
14. Ekombe's Imp.	96	22	78	90.5	95	16.8	59	88	92.5	80	80	60	100	58
15. Hollow Crown	100	6.9	90	87.5	97	14.7	61	84	83	54.5	89.5	42	84	52.5
16. Evesham	100	19.9	85	100	93	32.3	63	100	78.5	41.7	73	55	83.5	50
17. Smooth White	100	17.4	95	78	89	12.5	86	92	92.5	50	74	73	95	65
AVERAGE	98.7	15.6	80	87.9	94	17	66	86.2	89	59	82.5	70	88.5	55

where, at various times, varieties showed 100 per cent attack by carrot fly but only 40–50 per cent by canker.

In our opinion there is no direct connection between carrot fly injury and Parsnip Canker, even in the presence of moisture, especially as the tunnels made by the carrot fly larvae, although they rapidly assume a reddish-brown colour, usually remain clear-cut, and we have seen no evidence to support the view that they act as the starting point for further rotting.

Nevertheless, carrot fly injury is so widespread and, when severe, interferes to such an extent with the examination of the roots, that in future any parsnips grown for the study of canker should be treated for the control of carrot fly.

Association with Soil Conditions

Judging from the analyses of the soils from the varietal resistance plots of 1948, we concluded that canker is not connected with any deficiency in food materials. Regarding minor and trace elements, we have no analytical data, but the analyses showed that the plots contained adequate quantities of at least the major essential elements and were generally of high fertility. The soil *p*H of the plots varied from *p*H 6.0 to *p*H 7.6 but there was no marked difference in the amount or severity of canker between the various plots.

Parsnip Canker occurs on almost any type of soil all over the country, and in any given area is distributed throughout the crop haphazardly. We must, however, lay emphasis on the striking difference between the incidence of canker on light and heavy land at Wisley.

At Wisley there is both light, sandy soil, and a heavy clay loam with a high water-table, separated only by a ditch, on a flat, open field. It was possible, therefore, to arrange plots of parsnips within 50 yards of each other on these two different types of soil. The results were striking, the relative amounts of canker on the same varieties for monthly liftings in the winter of 1948–49 being as follows:

	Light Soil *per cent*	Heavy Soil *per cent*
October	4.2	48.3
November	6.1	73.2
December	15.6	87.9
January	17.0	95.2

This great difference in the amount of canker points to some factor associated with the heavy soil which has a decisive bearing on the incidence of canker. The usual steady increase in canker from October to January, even in the light soil, should also be noted. In our opinion soil fertility plays little part in the development of canker, and both plots experienced the same weather conditions, so that the only obvious responsible factor between the light and heavy plots seems to be moisture.

The appearance of canker on most soils seems to depend, as suspected by Cotton[1], on weather conditions. In the course of this investigation no signs of canker were found in the parsnips until the end of August. By mid-September the first signs of canker were noted at Wisley, while in a trial plot at Milford, Surrey, there were 25 per cent cankered roots, but few were severely affected. Adequate moisture and cool temperatures seem to be factors necessary for the development of canker. The fact that the trouble is influenced by weather conditions would explain its severity in certain seasons, usually wet ones, and its comparative absence in certain dry seasons such as 1947. Even in this year, however, there was a good deal of canker in the trial plots at Wisley in November, and this seems to indicate that in the late months of the year the usual rains may encourage canker even at the

end of a dry season. Another interesting point is that the stage of growth of the root itself does not seem to be important because canker appears about the same time, whether the crop is sown early or late.

The weight of the crop increases until November, but in heavy soils this advantage is offset by the increase in canker from October onwards. After November there does not appear to be any gain in weight and there is an ever-increasing risk of loss from canker. It would therefore seem best to lift parsnips from heavy land in October and from light land at least by November.

Effect of Canker on Saleable Roots During these experiments information was collected on the weights of those cankered roots which were unsaleable, as compared with clean, saleable roots.

Table 2
Comparison of Weights of Saleable and Unsaleable Roots from Light and Heavy Soils at four times of lifting
(Percentages of totals shown in brackets)

Date of Lifting	Light Soil			Heavy Soil		
	Total Weight	Wt. of Saleable Roots	Wt. of Unsaleable Roots	Total Weight	Wt. of Saleable Roots	Wt. of Unsaleable Roots
	lb.	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
Oct. 6 ..	400	361 (90.3%)	39 (9.7%)	586	439 (75%)	147 (25%)
Nov. 8 ..	527	495 (93.9%)	32 (6.1%)	696	450 (64.7%)	246 (35.3%)
Dec. 6 ..	520	450 (86.5%)	70 (13.5%)	603	315 (52.2%)	288 (47.8%)
Jan. 25 ..	561	405 (72%)	156 (28%)	545	135 (25%)	410 (75%)

Although in October the percentage of cankered roots in the heavy soil was nearly three times that in the light, there was still a greater weight of clean roots because the total crop in the heavy soil was 50 per cent more. By November, however, the weight of crop in the light soil had increased so that, taking into account the greater quantity of unsaleable roots from the heavy soil, the light soil gave the greater yield of saleable roots. This process continued so that finally, despite the fact that a greater total weight of roots was usually lifted from the heavy soil, there was a greater weight of saleable roots from the light land.

Varietal Resistance Trials In this investigation the inclusion of varietal resistance trials was due to the belief held by the writers that certain parsnips are less liable to canker than others. This view has been expressed by earlier workers and is still held by various people. In the trial, seventeen stocks of parsnips embracing ten well-known varieties were sown in various parts of the country. Trial plots were grown at Evesham, Worcs.; Houghall, Durham; Starcross, Devon; Gulval, Cornwall; Milford, Surrey and Wisley, Surrey (two plots), making seven plots in all. In these plots each of the seventeen stocks was planted to make 180 feet total run, and sixty feet of each stock was lifted for examination at approximately mid-November, mid-December and mid-January.

At each lifting, the roots of all varieties were examined and classified according to the degree of canker infection. On studying the results at the

conclusion of the trial, it was felt that no point could be gained by grading, and that an estimate should be made simply of those roots which were clean and those which showed any appreciable degree of canker.

From the results obtained it would appear that no variety or strain used in the trial is by its general behaviour worthy of being called resistant. After studying the results we are forced to the conclusion that no variety in itself possesses resistance to canker, although we still feel that individual roots show some degree of resistance.

Practically all the modern varieties of parsnips are of the Hollow Crown type—a character which has been the aim of breeders for some years. We found, however, that there is very little to choose between the various named strains (and even varieties) and that varietal trials are therefore unlikely to be helpful. For future experimental work we decided that parsnips are best divided simply into long, intermediate and turnip-rooted, and of these there is no doubt that the popular type among growers would be the intermediate such as are seen in certain strains of the varieties Offenham and Evesham.

In February, 1949, roots of a suitable type which still remained entirely free from canker were collected in several parts of the country with the idea that they may form a foundation stock for future selection, and these are being kept at Wisley.

Summary The present report can be taken only as a preliminary investigation on Parsnip Canker. The exact cause of the trouble has yet to be discovered, but we consider that various earlier theories have now been clarified. We believe that the exact origin of Parsnip Canker is not likely to be discovered by further field experiments, but that critical experimental work under carefully controlled conditions will be needed. In this connection we would draw attention to the following points for any future work:

1. The great difference in canker attack on the roots in light and heavy soil at Wisley seems to us an important factor.
2. We consider that some critical work should be done on the possible relationship between canker and root initials.
3. In any experimental plots in the open the elimination of carrot fly injury by suitable treatment of the plots should be a cardinal point.
4. In any critical experiment involving the use of bacterial cultures, the roots should be grown in sterilized soil of a type that retains ample moisture throughout the season.
5. Early lifting would avoid a great deal of loss from canker on heavy soils, and the question of clamping deserves further consideration.

The writers acknowledge with thanks the assistance and advice of all who helped in this work : the growers, N.A.A.S. officers, members of the seed trade, and colleagues at Wisley.

References

1. Diseases of Parsnips. COTTON, A. D. *Studies from the Pathological Laboratory: VI.* Kew Bulletin, 1918, 8–21.
2. Parsnip Canker. STIRRUP, H. H. and ROEBUCK, A. *Agriculture*, 1926–27, **33**, 824–6.
3. Progress Report on Vegetable Disease—III, Parsnip Diseases. OGILVIE, L. and MULLIGAN, B. O. *Ann. Rep. Long Ashton Res. Stn.* 1931, 129.
4. Progress Report on Vegetable Diseases—IV, Parsnip Diseases. OGILVIE, L. and MULLIGAN, B. O. *Ann. Rep. Long Ashton Res. Stn.* 1932. 119.
5. Progress Report on Vegetable Diseases—V. Parsnip Diseases. OGILVIE, L. and MULLIGAN, B. O. *Ann. Rep. Long Ashton Res. Stn.* 1933, 115.
6. Anguillulina dipsaci (Kuhn) as a Cause of Parsnip Canker. WALTON, C. L. *Ann. Rep. Long Ashton Res. Stn.* 1936, 156–9.

FARMING IN SOUTHERN RHODESIA

S. M. Makings, B.Sc., Ph.D.
Department of Agriculture, Southern Rhodesia

A BRITISH farmer, flying for the first time over Southern Rhodesia during the winter season, is likely to be impressed by two features of the landscape: the vast areas of virgin land, and the drought-stricken appearance of the whole panorama. Mile after mile of dried up veld is unrolled beneath him, the light-brown background relieved only by the dark stippling of trees and scrub or perhaps occasionally by the black patch of a recent fire. Every now and then he will pass over winding tracks of a river or stream, bone-dry for the most part, except, maybe, for a string of water-holes along the bed of the bigger rivers, and the occasional glint of a small dam with a green fringe of irrigated cropping, which serves only to accentuate the barren appearance of the surrounding countryside. Even in the developed agricultural areas, with their widely scattered farmsteads, each with its red patchwork of ploughed lands, his first impression is likely to be one of impermanency, contributed by the corrugated iron roofs of the homesteads and by the entire absence of hedges to suggest that the cultivated land has been permanently claimed from the surrounding scrub. In some ways, the picture probably resembles that of English agriculture in the early Middle Ages; the great unenclosed fields carved out of the surrounding moorland, tree-covered slopes which might pass as acorn woods, the huddle of native huts near the bank of a stream, the homestead on a small rise dominating the scene, and perhaps even an ox team raising its faint cloud of dust.

Set down in Salisbury, our traveller may wonder how this gracious city has been raised in the middle of the apparently inhospitable veld. Salisbury, with its spacious tree-lined avenues, its parks and gardens gay with strange and colourful flowers and shrubs, its modern shopping centre, traffic lights and cinemas, mills and factories, will probably strike the English visitor as well established, modern without much of the more garish features of city modernity, and contrasting sharply with any visions he might have had of a glorified shanty-town in the veld.

Perhaps contrast is the keynote of Southern Rhodesian impressions on the new-comer. Certainly for a farmer-settler from Britain the contrasting features of a new mode of life are likely to dominate his first impressions. There is the striking seasonal contrast between the six months' drought of winter and the six months' rainy period. Halfway through the dry season, with daily sunshine equal to the best of a good English summer, the new-comer begins to marvel that life can ever return to trees, much less to the scorched veld herbage. That those same trees can burst into leaf and bloom after nearly six months of absolute drought, and before a drop of rain falls, seems to border on the miraculous, and the luxurious growth which springs up from the dead veld after the first rains is something to marvel at. Then there is the contrast between the very old and the very new in agriculture, most sharply exemplified where primitive native agriculture stands almost cheek by jowl with the best use of scientific methods and modern equipment on a progressive "European" farm.* This contrast persists in a modified form within the European farming system, where native labour, because of its apparent cheapness, is used with a prodigality and for a range of tasks which would surprise the English farmer, alongside some of the latest farming

*All whites are referred to collectively as "European".

equipment, and where the trek ox vies with the tractor as a source of power. These are the contrasts of a country where the climate varies from temperate to tropical, a country which has one foot in a past centuries old and the other in the forefront of progress.

Enormous Scope for Expansion For although Southern Rhodesia is developing at a rate which brings a wide range of problems, she is still in the infancy of development; and in agriculture there is enormous scope for expansion. The total area of the Colony is 96 million acres, and of this 29 millions are set aside as native reserves and native (purchase) areas. Nearly 18 million acres are unassigned, that is, they may go either to the European or to the native areas, and 48 million acres constitute the present European area, of which about 15 million acres have not yet been alienated. Excluding the forest area of about a million acres, there is therefore about one-third of the country, apart from the native areas already assigned, not yet taken up for development. Much of this land is, of course, populated by natives, but they have no rights of permanent occupation.

Of the area of 33 million acres alienated to Europeans, some 26 million are returned as the total farmed area. This includes cattle ranching estates, varying in size from 50 thousand to 3 million acres, statistics showing that the farming area of 26 million acres comprises less than 5,000 occupied farming propositions. The total area of European-grown summer crops, (i.e., the arable area) in 1947–48 was just over 650 thousand acres, or about 2½ per cent of the farmed area. It has been estimated that only about 15 per cent of the area of the Colony is suitable for annual crop production, owing to the circumstances of climate and soil (including hills, kopjes and rock outcrops) but, even so, the proportion of land under cultivation in the area occupied by European farmers, covering much of the best land in the Colony, is very low.

Grazing utilization shows a similar picture. Total European-owned cattle runs between 1 and 1¼ millions, together with some 60 to 70 thousand sheep so that, even making a generous deduction from the 26 million acres of farming land for land unfitted for grazing, stock-carrying in terms of cattle is well below one beast to 20 acres overall. Climate is the limiting factor to cattle-carrying capacity, and the big ranches lie in the low rainfall area of Matabeleland. A fairly good ranch will carry one beast to 15 acres, but during the summer (rainy season) very much heavier stocking would be possible. The rancher is unable to take full advantage of his summer stocking capacity, however, for even with such hay and winter keep as he can get together, relatively heavy stocking brings risk of appreciable losses through poverty towards the end of the dry season, particularly if the dry season is prolonged.

It is clear that there is considerable scope for increased output, both from new land and land already parcelled into farms. Improving management, more paddocking and the extension of water supplies will increase stock-carrying capacity on the cattle farms. The extension of cultivated areas, improved rotational and manuring practice and better use of the veld grazings will increase output from crop and mixed farms. There is little doubt, moreover, that farms were originally parcelled out on too generous a scale. The crop farmer with 2–3,000 acres of veld and bush for his grazings has little incentive to improve the quality of these grazings. With the increasing value of land the tendency will be to make better use of it.

A Rhodesian Farmstead

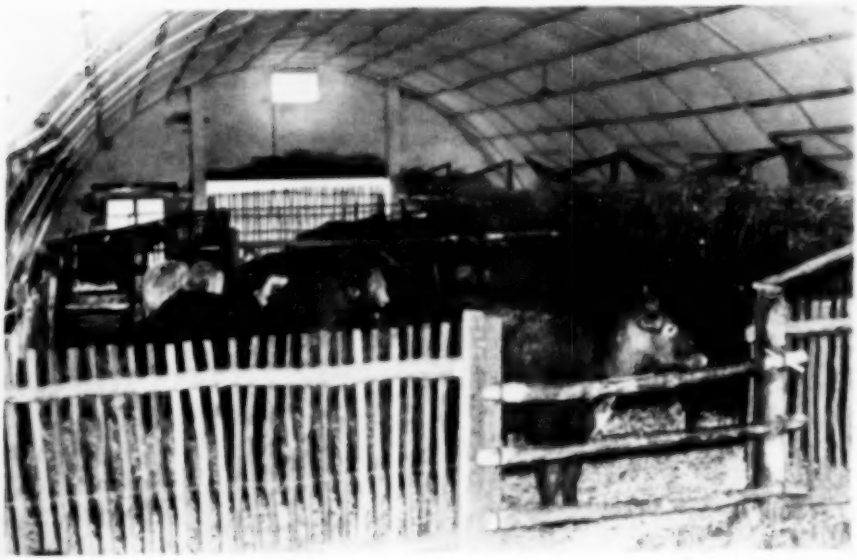
Harvesting Tobacco

Tobacco Auction Floors, Salisbury

Maize in Cob

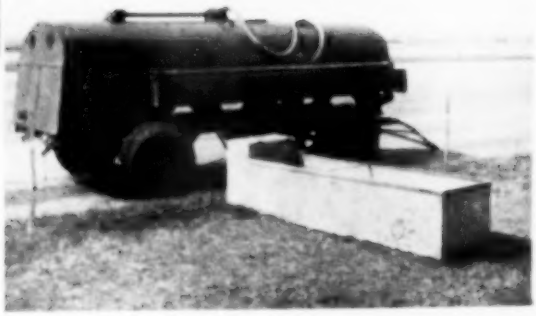
RHODESIA

Ox team contour-ploughing



Nissen hut housing young stock

Dehorned calves with Shorthorn and Lincoln Red Heifers (Summer 1949)



Water supply by the use of a W.D. Bowser

FARMING IN SOUTHERN RHODESIA

What one agent calls "good farming propositions" are making high prices today. The following extracts are taken from *The Rhodesia Herald* of December, 1949:

> App. 3,600 acre maize and tobacco farm with 10 barns. Good homestead. Everything in hand for season. 2½ miles large river boundary. Includes bullocks, tractor, etc. £11,500.
>
> Virgin cattle and tobacco land, heavily timbered. Fully fenced and paddocked, 45 miles Salisbury. Average 2,600 acres at £2 and £2/5 an acre.
>
> Very choice maize farm of over 2,700 acres with main road frontage and 2 rivers. Over 1,000 acres red soil in one block. Homestead and farm buildings. Nearest offer to £30,000.

The barns referred to in the first advertisement are tobacco barns, and assuming they are standard size, they indicate a tobacco area of from 100 to 150 acres. The bullocks are probably draught animals. This farm is no doubt partly red (maize) soil and partly the much less fertile sand veld. The second "proposition" is obviously sand veld, and the buyer would have to reckon on stumping and clearing proposed tobacco land at anything from £2 to £4 per acre. The phrase "heavily timbered" is significant, since this means a good supply of fuel for tobacco curing. Farm number three is the nearest approach to the English farmer's conception of a farm. It obviously has an appreciable proportion of arable, or potential arable of good quality, and the price is accordingly high. These farms are all in a rain belt of over 30 inches, that is, a good cropping area. By contrast the price paid for typical ranching land in the 15 to 25 inch rain belt would probably be round 5s. an acre in large blocks.

Tobacco, Cattle and Maize The three major products of Southern Rhodesian agriculture all featured in the foregoing advertisements, are tobacco, cattle and maize. The gross value of the Colony's agricultural output in 1947–48 was £13 million, and of this tobacco contributed over 7½ million, cattle slaughterings over £1½ million, and maize over £1 million. Dairy produce accounted for nearly £½ million and pig slaughterings rather less than £½ million, with no other commodity reaching £200,000. This comparison fails to do justice to the importance of the maize crop in the national economy—nevertheless as a revenue earner it ranks far behind tobacco.

Tobacco is now the major export product of the Colony. It occupies about a fifth of the summer crop, and production is rising towards a target of over a hundred million lb. per annum. Much the most important type is bright Virginia, although appreciable quantities of Turkish and heavy fire-cured Virginia types are also produced. Suitable soils for tobacco are the light sands, which comprise a high percentage of the soils of the Colony and, except for abnormal seasons, the climate is suitable over a great part of Southern Rhodesia. Tobacco cultivation and curing is a highly specialized job, and would-be growers generally spend a few years as assistants on tobacco farms. In view of the relatively high returns from this crop in recent years, there has been a tendency for growers to "go nap" on tobacco but this phase is likely to pass in favour of a move on the part of many large growers to ensure future stability by greater diversification, owing to the high risks of monoculture (tobacco is strongly susceptible to eelworm), and to the fact that occupiers of mixed farms are being attracted by the prospects of tobacco as a rotation crop.

The tobacco plants are raised in seedbeds and planted out in showery weather. After about a month's growth the lower four leaves are removed

(priming) and later the terminal bud and subsequent secondary shoots are also taken out. About three months after transplanting, the crop begins to ripen, the leaves turning greenish-yellow, becoming thick, brittle and rough on the surface. A good deal of the success in curing depends on harvesting at the right stage. Leaves are picked singly, and there may be from three to six pickings. The leaves are then strung in bunches, three to five leaves in a bunch, on sticks, each carrying about 32 bunches, in readiness for curing. There are several methods of curing. That most favoured is flue-curing in barns heated by wood furnaces. The curing and drying process, lasting from four to six days, is very highly specialized and on its success depends the market value of the leaf. After curing, the tobacco is rough graded and bulked, and it is then ready for dispatch to the commercial grading warehouses to be finally graded and packed for sale on the tobacco auctions.

The average price on the auction floors of Rhodesian flue-cured tobacco in 1949 was just under 32d. per lb., and the average yield just under 640 lb. to the acre. This gives a gross return of about £80 an acre for the most intensive crop produced in Southern Rhodesia on any appreciable scale. With 128,500 acres of tobacco in 1948 the gross return for this crop was well over £10 million.

In the above brief summary of the Colony's agricultural output for 1947–48 it was pointed out that maize did not get full justice. Maize must have good soil and adequate rainfall, and the very bad rainy season of that crop year reduced the yield to 3½ bags (of 200 lb.) per acre, whereas the normal average is between 5½ and 6 bags, and good growers expect 12 bags or more. In the following year, with an increased acreage and a yield of nearly 6 bags per acre, output was more than doubled and the total European production was worth nearly £3 million.

Maize production is vital to the national economy for, apart from its importance as stockfeed, it is the basis of the native diet. Rations provided for natives in employment usually include about 2 lb. per head per day of maize meal as the staple item. Sales within the Colony by the Maize Control Board (which handles the whole of the crop marketed) amount to over 1¾ million bags per annum, and any short-fall from this quantity in home production has to be made good by imports. Thus heavy importations at relatively high cost have been necessary in recent years, and the Government drive to achieve self-sufficiency through increased production and surplus carry-over in good crop years has so far been unsuccessful in spite of price increases which have raised the price per bag from under 10s. in 1939 to a guaranteed price of 35s. for 1950.

The crop is chiefly grown in the rain belts of 25 inches or more on the fertile red soils, but even here the grower faces a very difficult problem in attempting to retain and build up fertility. Some growers put their maize lands down to green manure crops every other year and many bring in the green crop every third year, including as part of the rotation some fertility-maintaining crop such as groundnuts (monkey-nuts) or legume hay. Composting, with compost made in night kraals for cattle, is widely practised, but many of the crop farmers have not yet reached the desirable balance of stock to crops in the face of the winter feed problem, and attention is being directed to the possibilities of leys. Here a major difficulty is presented in that perennial clovers cannot survive the six months' dry period, ordinary types of annual clovers do not give the bulk for ploughing-in which is provided by

sunn-hemp*, and many of the grasses are difficult to establish from seed. Work is proceeding with suitable grasses, however, and the grass leys may come to play an important part on maize and mixed farms.

Seed is machine planted after the rains have got properly started in late November or December. It grows rapidly if the rains are adequate and well-distributed, and thereafter the main job is to keep the crop clean, a task in which tractor cultivation is fast making headway against the old system of native and ox labour. The crop is usually ready for harvest about the end of June, and here the Rhodesian farmer has one advantage over his British counterpart in that he is certain of three or four months without rain. The maize is generally stooked to allow ploughing of the land. The cobs are then stripped and thrown into heaps for carting to the homestead, where they are filed outside to dry out. When well dried they go through the mechanical sheller and the grain is bagged for delivery to the Maize Control Board. Trials with mechanical pickers indicate that this method may reduce much of the labour of harvesting if, as is expected, the use of hybrid seed ensures a much more uniform height of cob. Hybrid seed, developed by the Department of Agriculture, should be available to all growers by 1952, and it gives promise of raising average yields by 15 per cent or more.

Prospects for Livestock Although farming emphasis in South Rhodesia, dominated by the tobacco position, is at present on crops, it is probable that in later stages of development, the balance will swing to livestock, with exports of meat eventually playing an important part in the national economy. With the recent rapid increase in the European population and with meat consumption by natives steadily rising, beef exports have ceased, and the country now has difficulty in providing its own meat requirement on an unrationed basis. However, the Colony is essentially a pastoral country—tsetse fly now occurs over little more than one-tenth of the total area, probably only a small part of which could be ranched—and development will bring not only great additional areas into cattle production but will also appreciably increase the output from lands already stocked.

A fair-sized cattle ranch run on a company basis is in the neighbourhood of 250,000 to 400,000 acres but a considerable part of this may be entirely undeveloped. Under present methods it is probable that the minimum size for an economic unit is 20,000 acres or so, increasing in the lower rainfall areas. Development consists in such tree and bush clearing as is necessary, the provision of water supplies, of dips, and fencing (barbed wire) into paddocks—often of considerable area. This may cost anything from 7s. 6d. an acre, depending on the conditions and the amount of work done. A cattle rancher without European assistants needs a minimum of about 1,000 head of stock to make a living and, of these, his breeding cows will cost about £8 to £10 a head and his bulls £30 to £50 each. Running costs will probably be between 15s. and 20s. per head per year, with about a third of the herd breeding each season. Mortality is relatively high, both in the calf stage and through poverty losses in the dry season if it should be prolonged, except under very good management. The cattle take four or five years to mature and probably about 10 to 15 per cent of the herd will come forward for sale annually. Marketing is highly developed through the Cold Storage Commission, a statutory non-profit-making body with abattoirs and modern processing plant at the main centres. Prices returned to

* A large-leaved plant grown for ploughing-in as a green manure. It is grown extensively in the United States, where it is known as *crotalaria*.

producers vary according to grade and month of delivery, and now average between 80s. and 85s. per 100 lb. cold dressed weight in the better grades, with a bonus of 10s. per 100 lb. c.d.w. on the heavier carcasses (over 600 lb. c.d.w.) to induce better finish.

The dry season handicap, which is a major limiting factor in the ranching industry, presents an even greater challenge to the spread of dairying. Liquid milk producers, representing one of the most intensive forms of agriculture so far developed, resolve this problem by laying down adequate stocks of silage (usually maize silage) and high quality legume hay for the winter, and much of the emphasis on the true dairy farm is on the arable cropping, supplemented to some extent by irrigation. The manufacture of butter and cheese is therefore largely carried on in the form of summer production as a side-line of ranching and mixed farming. Thus we have a position in which our (summer) census of cows milked shows some 55,000 head against a total annual output of about 8¼ million gallons, an overall average of 150 gallons per head. However, it is estimated that the true dairy herds, representing about 40 per cent of cattle milked, have an average output of about 300 gallons per annum, and herd average yields of 700 to 800 gallons per annum are not uncommon. The most popular dairy breed is the Friesian, followed by the Red Poll, with the Ayrshire, Guernsey and Jersey favoured by some.

Although native labour is cheap and cattle can remain outside day and night throughout the year, so cutting the cost of both housing and attention, the uniform production of milk is relatively costly and the producer for liquid sale is guaranteed a price of 2s. 5½d. per gallon in summer and 2s. 9½d. in winter, with the opportunity of earning an additional quality premium of 4d. per gallon. Cream producers, marketing their product through their co-operative butter factories, get 2s. 9d. per lb. for butter fat in summer and 3s. 7d. per lb. in winter. Butter fat from the dairy-ranching system, largely in the low-rainfall areas, is mainly summer production. Under this system the calves, which are suckled by their dams, are separated from the cows at night and the cows are milked in the mornings only.

About half the total milk produced is sold as liquid milk, about 40 per cent is used for butter, and the balance of just over 10 per cent is divided fairly evenly between cheese manufacture and other uses. At the present rate of butter production, and with a ration of ¼ lb. per head per week, the Colony can produce only about half its butter requirement, and prospects of achieving self-sufficiency are remote. Liquid milk supplies have so far been sufficient to avoid the necessity for milk rationing but shortages are not uncommon during the dry spell.

Although the foregoing lays emphasis on the major specialized forms of production, there is a good deal of mixed farming in the Colony, and apart from cattle ranching, an appreciable part of the specialized production discussed above comes from mixed farms. Moreover, mixed farming—generally with a cash crop addition and embracing pig production, dairying, and some yard feeding of cattle and including small-scale irrigation schemes—is expanding and will help towards the solution of the dominant problem of fertility maintenance. Groundnuts and cotton, not yet grown extensively by Europeans, are likely to play an important part in the development of mixed farming, more particularly if cotton-picking machinery (to be tried this year) proves successful and if the lifting of groundnuts can be readily mechanized.

The Native Labour Problem Amongst farmers' problems, the growing scarcity of native labour in relation to demand, ranks high. The rapidly increasing European population, expanding urbanization, and the development of secondary industries, draw more and more natives to the towns. The flow of migrant native labour from the Northern territories has slackened and the steadily increasing requirement of tobacco growers (well placed in competition for labour) has made the position difficult for food producers. About 150,000 natives are employed in agriculture, an average of about thirty per farm, or about one to 4 acres of arable cropping. This will appear high to the British farmer but it must be recognized that the average native has no moral compunction in connection with work, and output per head is very low. Pay is about 30s. monthly, plus rations—most of the latter produced on the farm—with key workers (boss boys, tractor drivers, etc.) getting up to £3 or £4 a month. A most important feature of good farm management is the ability to handle native labour.

Increasing mechanization may provide a partial solution to the labour problem, but with a plentiful source of apparently cheap labour, the move towards mechanization came late, was heavily retarded during the war period when new equipment was difficult to obtain, and is now proceeding in the face of high cost and continued difficulty in supply. In 1948, for instance, there were just over 2,000 tractors amongst 4,800 farms, an average of one tractor to about 325 acres of arable, and in that same year over 100,000 trek oxen were in service.

This brief survey has touched on some of the main problems facing the Southern Rhodesian farmer. His difficulties are probably on a bigger scale than those of his English counterpart, but if Nature here can be much harsher, she can also be much more generous, and for the most part the farmer enjoys a full and varied life. Social amentities and sporting facilities are well developed in the most remote communities, and distance from urban centres, even on inferior roads, is less of a handicap than it might seem. In these days of high cost, adequate capital is necessary to start a farm, but given the capital plus energy, receptivity to new ideas and capacity for work, farming in Southern Rhodesia offers opportunities for a career which it would be hard to better.

DRY ROT OF POTATOES

C. E. Foister, Ph.D.
Department of Agriculture for Scotland
and
A. R. Wilson, Ph.D.
Agricultural Research Council

MOST growers of potatoes, particularly those concerned with the early crop or the production of seed for it, are familiar with Dry Rot* and the losses it may cause. Many, however, appear to be unaware of exactly where the infection comes from, when and how it occurs, and how it may be prevented. During the past eight years, co-operative work by the Agricultural Research Council and the Department of Agriculture for Scotland has yielded a considerable amount of information on various aspects of the disease in Britain, only a portion of which has so far been published[1,3,4]. During the war years, Small[5,6,7] also contributed

* Dry Rot is described and illustrated in Advisory Leaflet No. 218

much towards the elucidation of the problems involved. The present article summarizes the main results of this recent research and discusses what practical steps can be taken to reduce losses from the disease.

Over 90 per cent of the Dry Rot occurring in this country is caused by the fungus *Fusarium caeruleum*, the remainder resulting from attacks by other closely related fungi. The disease develops most rapidly at temperatures of about 60° F., and under these conditions the first symptoms of rotting appear three or four weeks after infection. During the winter, when temperatures are usually much lower than this, development is slower, and where infection has taken place in late autumn or during the winter, the presence of the disease may not be noticed until storage temperatures rise in the spring. This long incubation period, during which the potatoes may be moved from one place to another, often makes it difficult to relate losses to the time and place at which infection occurred.

This difficulty is not lessened by the fact that there are a number of causes for variation in the amount of disease present in different stocks. These are: (1) differences in varietal susceptibility; (2) changes in susceptibility of the tubers as the season advances; (3) differences in infestation of the soil in which the tubers were grown; (4) extent of wounding of the tubers; and (5) time at which wounding occurs.

With the exception of Epicure and Home Guard, which are relatively resistant, most early varieties are very liable to infection. Among the most susceptible are Ninetyfold, May Queen, Catriona, Arran Pilot, Sharpe's Express, and Doon Early. Doon Star is extremely susceptible, and Majestic, Dunbar Standard and Redskin moderately so; other maincrop varieties are not often severely attacked. Tubers are least susceptible early in the season, and susceptibility increases during storage, reaching a maximum in early spring.

The fungus *Fusarium caeruleum* has been shown to be present in the soil in almost every area where potatoes are grown. The degree of infection varies greatly between fields, even on the same farm; usually, there is a rise in the amount of *Fusarium caeruleum* in the soil following the growing of a susceptible variety, and a slow fall again in the intervening years before the next potato crop is taken in the rotation.

Wound Infection Undoubtedly the most important factor determining the extent of infection with Dry Rot is the amount of damage sustained by the potatoes during handling. *Fusarium caeruleum* is a wound parasite, incapable of penetrating the undamaged skin of the tuber. The infection that takes place when tubers are wounded comes nearly always from fungus present in soil adhering to their surface. What, therefore, are the main periods at which potatoes suffer wounds that may provide points of entry for the Dry Rot fungus? There are three such periods: (1) at harvest time; (2) during riddling and transport; and (3) during storage.

At harvest time relatively little damage is caused, unless the harvesting machinery is badly adjusted. In other words, a high proportion of the tubers normally remain undamaged; the damage to individual tubers may be severe—such as slicing or cracking—but is usually confined to a small proportion of the tubers only. (This does not apply, of course, to "harrowings" which are invariably extensively damaged.)

The second period of damage risk is at riddling time. Machine riddling causes little obvious injury, but few tubers escape minor skin abrasions; these may be invisible to the naked eye, but nevertheless provide perfect avenues of entry for the fungus. Many experiments point to the importance

of riddling injury in the development of Dry Rot infection, a typical example being given in Table 1 on p. 232.

After riddling, careless handling of bags during transport may cause considerable damage. And finally, there is handling during storage. This usually consists of "picking over" a stock of seed in boxes during the winter, to remove infected tubers. It is usually undertaken with the idea of preventing spread of the disease, but from this point of view it is unnecessary, as contact infection—except of freshly damaged tubers—has been shown to be extremely rare. If anything, therefore, picking over may be harmful since, in the process, undamaged tubers become contaminated with Dry Rot spores from pustules on the diseased potatoes, and may at the same time suffer minor abrasions through which further infection could occur. It is also bad practice to "turn over" a clamp of seed of a susceptible variety unless absolutely necessary, as the risk of infection is serious.

The last factor affecting the extent of infection is the time at which wounding occurs. As stated above, infection at harvest time is usually not severe. On opening a clamp of ungraded tubers of a susceptible variety, even when the crop has been grown on a highly infested soil, it is rare to find more than 1 or 2 per cent affected by Dry Rot, provided the clamp has not been disturbed. It is when riddling is carried out a month or so before tubers are required for planting that the most serious losses may occur, since at this time the tubers are becoming very susceptible.

Bearing in mind the importance of the extent and time of damage to the tubers, the incidence of Dry Rot under the following sets of conditions can readily be understood. (1) The disease is rarely serious in crops grown for use as ware, as in this case riddling is usually carried out only a few days before marketing. (2) Where either seed or ware is reclamped after riddling for a further period of storage, Dry Rot may be severe. (3) Dry Rot is more prevalent in seed transported from Scotland or Ireland to England, or from one part of England to another, than it is in seed retained on the farm of origin. This is not so much because of transport damage, but because in transported seed riddling usually takes place several months before the seed is required for planting. Where "home-saved" seed is riddled during the autumn or winter, Dry Rot may also be severe; but it is quite usual for the riddling of such seed to be postponed to within a short time of planting, or even dispensed with entirely.

Careful Handling Apart from growing varieties relatively resistant to the disease, Dry Rot may be controlled by (1) careful handling, (2) chemical disinfection of the tubers *at lifting time*, or (3) by a combination of both methods. Damage at lifting may be reduced by "burning off" the haulm well in advance or otherwise ensuring maturity and toughness of the skin, and by making certain that machinery is correctly adjusted for depth and speed and, with diggers, that agitation of the chain belt is no more than adequate. Rough handling of tubers from picking baskets to carts, walking on the loads, careless forking during clamp construction and similar forms of damage should also be avoided.

In the case of home-saved seed, riddling or any other form of grading should be deferred until not more than two weeks, or preferably a few days, before the tubers are required for planting: the disease will then have insufficient time to develop. Chemical treatment of the tubers is then usually unnecessary. When it is not possible to delay riddling until shortly before planting, as in the case of most seed sent from Scotland or Ireland to England, there would be considerable advantage if the seed of susceptible early varieties could be hand graded, either direct from storage or by an inclined

slatted "picking table" down which the tubers are rolled gently into a sack attached to the lower end(1). Table 1 shows the different levels of infection that followed such methods of hand-grading in one experiment, compared with those that followed the use of the standard type of reciprocating machine grader. Another method of reducing damage is to grade the potatoes by hand as they pass along a moving belt. Should hand-grading by one of these methods be impossible, the use of rubber-coated riddle screens is advocated. Preliminary tests have also shown that damage (and consequently infection) can be reduced substantially by using American "rubber spool" graders. Such machines, however, are not at present obtainable in Britain. All Scotch and Irish seed has been graded before dispatch and should not be graded again on receipt, except just before planting, if necessary. The figures given in Table 1 show that where tubers are graded twice infection may be seriously increased.

Table 1

Development of Dry Rot in Arran Pilot Graded in Four Different Ways

(Tubers lifted and clamped in October, graded and dispatched from Scotland to England in December)

Method of Grading	*Percentage of Dry Rot (April)*
Hand picked	4
"Table" graded	3
Machine* graded (once)	16
Machine graded (twice)*	24

* Reciprocating riddle, bare wire screen. † To simulate regrading on receipt

During transport, care should be taken in handling bags. Where these are allowed to fall from shoulder height to the ground serious damage may be caused. Tubers should be emptied into the sprouting boxes as carefully as possible.

Chemical Disinfection When the grading of susceptible varieties cannot be deferred until immediately before planting, it is probably advisable to adopt some form of chemical treatment of the tubers—certainly such treatment should be adopted when susceptible varieties are to be machine-graded. Two forms of chemical treatment give satisfactory results—a wet treatment and a dry treatment. The latter is so easy to apply that it has almost entirely superseded the wet treatment. It consists in treating the tubers *on lifting* with a dust containing tetrachlornitrobenzene.* The easiest way is to dust the potatoes as they are loaded into the carts in the field. An example of the results obtained by this method of control is given in Table 2.

Table 2

Effect of Treatment with 3 per cent Tetrachlornitrobenzene Dust on Development of Dry Rot

(Tubers lifted, treated and clamped in October, riddled and dispatched from Scotland to England in December)

Variety	Percentage of Dry Rot (April)	
	Untreated	Treated
Arran Pilot	18	6
Arran Pilot	16	2
Sharpe's Express	12	4

* A suitable proprietary compound (Fusarex) is on the market.

As the compound volatilizes slowly, treatment should be followed by at least four weeks in a closed environment, such as a clamp, in order that the vapour may take effect. The dust has a pronounced retarding effect on sprouting and care should be taken, particularly with early varieties, to follow the period of closed storage with about three months storage in boxes in a well-ventilated store. Yield trials carried out with Arran Pilot have shown that at least with this variety, where this routine is followed, there is no retardation of bulking, no reduction in yield and no significant decrease in the proportion of saleable ware when the crop is lifted at the earliest possible time.

Other Precautions Available evidence indicates that a wide rotation reduces soil infection by the Dry Rot fungus, but this has little value as a method of control since the fungus can remain viable in the soil for very long periods in the absence of the potato crop. On general grounds, however, close cropping with susceptible varieties should be avoided. Any steps which can be taken to reduce infection are very desirable and, for this reason, diseased seed should not be planted but should be collected and buried or otherwise disposed of away from arable land. Partially rotted tubers should never be planted for the same reason, but more particularly because a "gappy" stand will result under all but the most favourable growing conditions.

Greening of seed in boxes in the field after lifting is of doubtful value in preventing Dry Rot, although the skin toughens more rapidly with this treatment and subsequent handling damage may thereby be reduced. Seed of susceptible varieties should preferably be boxed on receipt and not stored in bags or clamps. This applies also to local stocks of such varieties from which the ware has been removed. "Harrowings" of susceptible varieties should preferably be disposed of as soon as possible after lifting. Where this is not possible they should be clamped separately from the rest of the crop. As the main source of infection seems to be soil on the surface of tubers, the disinfection of stores, sprouting boxes, etc., has little value, provided care is taken to minimize damage to the tubers when filling boxes or during storage. The leaving of heaps of diseased discards in stores should nevertheless be avoided.

Grateful acknowledgment is made to Dr. A. E. W. Boyd and Mr. R. K. McKee for assistance in the experimental work.

References

1. A Potato Chute for the Farm. Anon. *Government of N. Ireland Min. of Agric., Talks to Producers No.* 40.
2. Some Recent Results of Potato Dry Rot Research. Boyd, A. E. W. *Ann. appl. Biol.* 1947, **34**, 634.
3. Dry Rot in Seed Potatoes. A Summary of Some Recent Experiments. Foister, C. E. and Wilson, A. R. *Agriculture*, 1943, **50**, 300.
4. Potato Dry Rot and Gangrene as Soil-borne Diseases. Foister, C. E., Wilson, A. R. and Boyd, A. E. W. *Nature*, 1945, **155**, 793.
5. Dry Rot of Potato (*Fusarium caeruleum* (Lib.) Sacc.). Investigation on the Sources and Time of Infection. Small, T. *Ann. appl. Biol.*, 1944, **31**, 290.
6. The Effect of Disinfecting and Bruising Seed Potatoes on the Incidence of Dry Rot (*Fusarium caeruleum*) (Lib.) Sacc.). Small, T. *Ann. appl. Biol.*, 1945, **32**, 310.
7. Further Studies on the Effect of Disinfecting and Bruising Seed Potatoes on the Incidence of Dry Rot (*Fusarium caeruleum* (Lib.) Sacc.). Small, T. *Ann. appl. Biol.*, 1946, **33**, 211.

CARNATIONS FOR THE CUT FLOWER MARKET

PETER H. CHAPLIN
Sunbury-on-Thames, Middlesex

MEADHURST PARK NURSERY was founded in 1907 by Mr. T. H. Chaplin and laid down entirely for the production of carnations for the cut flower market. The nursery occupies seven acres, nearly four of which are covered with glasshouses running north to south and set at right angles to a central roadway alongside which are conveniently placed the various sheds, stores, boiler-houses, packing shed, etc. Around the perimeter of the nursery, turf is grown to augment our supplies of top spit. The houses themselves are mostly in pairs, the larger 250 feet × 60 feet, the smaller 120 feet × 60 feet.

Until 1939 cropping was one hundred per cent carnations. These are grown for three years, after which they are pulled out and the houses re-soiled. It is so arranged that one-third of the nursery is re-soiled and re-planted every year. We paint the outside of the houses every three years and the inside every six, so as to coincide with the termination of a crop.

Our houses have overhead heating supplied by low pressure hot-water boilers thermostatically controlled and dependent upon the water temperature. By eliminating the house thermostat, there is the minimum lag in temperature. In an endeavour to obtain maximum efficiency with the utmost economy our late Mr. W. E. Chaplin designed a fire-bar which fitted between the water bars and thus became virtually water cooled with resultant freedom from burning and consequent long life. It is so designed that the air is deflected sideways and spreads over the whole grate area, so giving complete combustion. The chamfered edge of the bar allows only $\frac{1}{8}$ inch space, so making it possible to burn the smallest and cheapest grades of fuel without formation of ash. The system proved so successful that we found we could reduce the actual grate area of the boilers by as much as one-half. After ten years of use we are more than satisfied with the installation itself, but consider that still greater economy could be effected with automatic stokers.

On the outbreak of war we devoted our attention to the cultivation of tomatoes and lettuces. The latter proved a useful catch crop, but the former had economic drawbacks, for overhead heating is not conducive to early cultivation, and moreover, since each house is divided into ten beds with a path between each, we are unable to get the optimum number of plants per acre.

Nursery Mechanization We are now steadily returning to normal cropping, but because skilled labour is difficult to obtain and costs of production are high, we realized that we must mechanize as much as possible and generally bring our business into line with other progressive industries. A rotary cultivator has superseded hand digging and is giving infinitely better results; for mixing and turning in manures and fertilizers it is perfect. Contrary to some theories, we find this machine neither pulverizes nor "pans" the soil owing to the actions of the "tillers"; but common sense must be employed in the use of the variable gears. Besides cultivating we use this machine for loosening up the beds when re-soiling, mixing compost and shredding top spit.

The tedious task of re-soiling has been changed—in fact we have abolished "barrow humping" altogether—by modifying a small motor truck so that

it can be used within the confined space of a greenhouse. A detachable tipping body is fitted and by the use of a second body and pick-up stands, one can be hauled away (at 6 m.p.h.) whilst the other is being loaded. This little truck will carry half a ton with ease and besides being generally useful for re-soiling, it is invaluable for coaling the bunkers and shifting dung. A platform body can be fitted for carrying plants.

The really efficient distribution of fertilizers has yet to be solved; so far there is no really suitable distributor upon the market for greenhouse use. However, a Danish firm are showing very great promise in this direction and we believe that before long we shall have the ideal machine. Our fertilizers are stored in a long, narrow building designed specially for the purpose. It is divided into bays so that all fertilizers can be kept in an orderly manner, so avoiding waste and confusion.

We are fortunate in having an ample supply of water, but as we have an exceptionally well-drained soil, our main problem is speedy and efficient application—a factor of immense importance in maintaining the health of the plants. As none of the conventional irrigation systems is suitable for our purpose, we have designed a semi-automatic unit and are steadily equipping all our houses, which will enable one girl operator to water one-sixth of an acre in the time it would normally take four girls using hosepipes.

Spraying for Pest and Disease Control Pest control, and (experimentally) disease control, is by the aerosol method. A modified paint spray gun is used, the air being supplied at 120 lb. pressure by a compact portable compressor. By this method we are able to treat 7,200 cubic feet per minute and obtain practically complete control. Our principal pests are red spider, greenfly, and carnation tortrix moth; for the control of the red spider and greenfly in all stages we use HETP and azobenzene mixed in equal proportions; for the carnation tortrix moth we use DDT. A fifty-fifty mixture of DDT—HETP seems to be the most useful as a routine spray for all three pests, but unfortunately, as far as red spider is concerned, this only kills the adults. We insist upon operators wearing respirators, eye-shields, and gloves when fumigating. Generally speaking, far too little attention is given to this precaution.

We have made some trials with E.605 in the form of a wet spray, but find that not only is it dangerous to use, but to obtain comparable results with azobenzene we have to quadruple the number of applications. Smokes are easy to use, but we found them expensive and wasteful and only obtained mediocre results. Wet spraying, apart from being slow, is unsuitable, as most carnation foliage is difficult to wet and most of the effective wetters or spreaders have an adverse effect upon the plant. Silica base dusts, however, are most useful, particularly DDT. This is applied by a small blower operated by the air compressor.

Efficiency in the Packing Shed In the packing shed we are installing gravity rollers to minimize the handling of packages, and upon the bench each girl has an "easy reach" tray for all her packing impedimenta. Our carnations are divided into three grades and each bears a distinctive label. The packer's number is clearly shown within the box.

Mechanization needs serious study, for it is easy to defeat one's object in buying and maintaining expensive equipment, but if carefully planned saving of labour and a high standard of efficiency may be built up.

We find, too, that it pays to take a personal interest in the staff. Giving the packers the opportunity of visiting one's market pays a handsome dividend, and they learn more in an hour than can be taught in a month on the

bench. An idea we are now trying is to have a photograph of an "ideal" pack in prominent position in the packing shed with the view that the sub-conscious mind will be impressed and so reflect upon the standard of work. Time will tell!

To build up a good staff is a slow job, and requires much patience. We endeavour to provide the best possible conditions and encourage them to take a pride in their work, for which a good wage is paid.

Last, a really efficient office is a prime necessity, with accurately kept analysis of returns and records of stock, cropping, etc. Each house has its own record card, which is carefully kept and checked once a week so that a complete history of the whole establishment is recorded.

PACKING APPLES IN RETURNABLE MARKET BOXES

ROBERT HART, N.D.A., N.D.H., N.D.D. and N. STEWART, N.D.H.
Kent Farm Institute, Sittingbourne

IN 1944 a Ministry of Food Statutory Order (S.R.O. No. 187, as amended) prohibited the use of non-returnable containers made from wood. In substitution, the now familiar returnable boxes became widely used for apples and other fruits and vegetables. Three types are available—bushel, half-bushel and quarter-bushel—though the last is very little used in the apple trade. The standard dimensions of the first two are:

Bushel Measuring ends $\frac{7}{8}$ inches, sides $\frac{5}{8}$ inches and bottom $\frac{3}{4}$ inches. Four triangular corner posts are fitted which may be flush with the top or project about 1 inch above. The ends are wire or steel strapped, and handle holes may be provided. The internal dimensions are 20 inches $\times 13\frac{1}{2}$ inches $\times 10$ inches which, including the space taken up by the corner posts, gives a capacity of about 2,620 cubic inches.

Half-Bushel Wood thicknesses are the same as for the bushel, with internal dimensions of 16 inches $\times 11$ inches $\times 7$ inches and a capacity, including the space taken up by the corner posts, of about 1,200 cubic inches. Blind handle holes only are permitted, and these can be provided by cutting away half the thickness of the timber at suitable points on the ends.

Boxes of these types are now very widely used for apples, but they cannot be considered ideal and bear no comparison at all with the pre-war British Standard apple box, either in capacity or usefulness. This latter box was hygienic, and was easily stored and built up. It was light, and constructed to permit the easy packing of most popular varieties of apples in a reasonable range of sizes.

The present market boxes, except when new, cannot be considered hygienic and the only thorough way of disinfecting them is by fire. The fact that each is used, on an average, two to five times means that it is bound to pick up a considerable amount of filth, associated with which are two most important diseases and pests of apples—Brown Rot and codling moth. Nor are the boxes easily stored; they take up a great deal of space empty in transit to the grower and on the farm, added to which they are so often used for other purposes. They are rarely built up from the flat by the grower

and are usually supplied by specialist box-makers or timber merchants. The grower can, and often does, repair damaged boxes at the end of the marketing season and market salesmen are generally willing to refund the cost of such repairs. They are not light; dry softwood bushel boxes weigh at least 8½–9 lb., new hardwood boxes 13 lb. and boxes which have been exposed to the weather and are wet and dirty, weigh up to 15–17 lb. each. These weights can be compared with the normal weight of a bushel B.S.A. of 6 lb. The question of weight, viewed in the light of transport and handling charges and the extra fatigue in the packing-house, is important.

The market box is difficult to fill attractively. The overall dimensions make it impossible to pack so as to give the same regularity of count such as is possible with the B.S.A. Furthermore, there are slight but important dimensional differences between market boxes in use. Where one salesman or organization is being supplied with fruit, the packer can, after some experimenting, arrive at a satisfactory layout and positioning of each apple in relation to its neighbour and the parts of the box. Where two or more salesmen are being supplied and there are varying box dimensions, considerable difficulty can arise in maintaining regular output. The thickness of the wood in construction prevents any attempt to build up a bulge, and in any case the production of a bulge is liable to result in the top layer being bruised, especially if this protrudes above the level of the top of the box or line of corner posts. The importance of a moderate bulge in the B.S.A. box pack was that it did ensure that the fruit remained tightly packed in the box, even after considerable delay in dispatch or ultimate sale. In the market box, normal shrinkage is not taken up in the same way, so that in the event of delay in transit or at the market, the pack becomes loose and considerable bruising is likely to result.

The pre-war B.S.A. had a square end (actually it was 1 inch wider than it was deep in order that the action of pressing on the lid would tighten the pack). Thus any sized apple, other than the very large culinary ones, could be made to fill the box completely, there being as many layers in the box as rows in each layer.

Owing to the shape of the end of the returnable box (10 inches deep × 13½ inches wide), the number of "pack indicators" does not necessarily indicate the number of layers in the box. Indeed it is a matter of chance whether the box will be properly filled or not. One size may conveniently fill it, while apples slightly smaller or larger may make the pack too low or too high respectively. Not only does this make it practically impossible to pack different sizes to a uniform net weight—thus adding to the difficulties of the salesman and retailer, and rendering the declaration of the net weight of each individual package a necessity—but it also causes confusion and waste of time in the packing house, thus slowing up output and increasing packing costs. With a large flat apple like the Bramley's Seedling, the level can sometimes be corrected by packing one or two layers eye upwards instead of on the cheek, but in many instances the box can be adjusted only by the use of a pad of wood-wool, either as a made-up "filler" wrapped in paper or as a mass teased out of a bale. This kind of packing leaves much to be desired. If the pad is placed under the apples, although the package may appear full when it leaves the farm, the weight of the fruit will very soon compress the wood-wool and the pack will look very slack by the time it reaches the market. If, on the other hand, the pad is placed on the top, it interferes with the free inspection of the contents; and this is an additional disadvantage in view of the increasing use of box covers containing a panel of transparent wrapping to enable the pack to be inspected without breaking the seals.

PACKING APPLES IN RETURNABLE MARKET BOXES

How to Pack The corner posts of the returnable box make it difficult to produce attractive packs, especially where the number of apples needed to complete each longitudinal row is the same (e.g., 6-6). This applies to any type of pack. With 2 - 2 and 3 - 3 packs it may be necessary to offset a smaller apple where the top and bottom rows across each layer abut on to one of the posts.

Except with an even number of layers, the bottom layer must be started with the smaller number of the count and not the larger, as would be the case in normal packing. For example, in a 3 - 2 pack filling the box with five layers—the bottom layers should be started with two apples—then three; the corner posts are thus avoided, and as the bottom, middle and top layers are identical, at least one end of the box is finished off tidily. If the size of apple gives an uneven pack longitudinally (e.g., 6 - 5 or 7 - 6, etc.), then the packer's job is easy because the top layer will fit at all four corners and it will be in only the second and fourth layers that small apples will have to "offset" in the corners. In the case of longitudinal rows which contain even numbers, it is practicable to fit in smaller apples at the top corners in order to hold firm the apples in the next transverse row.

The following table gives an indication of the layout which is possible in the returnable bushel box, in the case of Bramley's Seedling, probably the most difficult apple to pack attractively in this box.

Size	Layout	Layers	Weight
In.			*lb.*
4	2×2; 5×5	3	40
3½	2×2; 7×6	3	43
3½	3×2; 5×5	4	40
3	3×2; 7×8	3	40
2½	3×3; 6×6	4	40
2⅜	3×3; 8×8	4	41
2¼	4×3; 6×6	5	43

Experience in using the standard returnable box has proved that net weight is very much related to the compactness of the fruit in the box, in other words, the openness or closeness of the pack. For example, it is obvious that where apples in a vertical square section fit closely, the apples in a neighbouring section will stand off from them and produce an "open pack", with comparatively few apples in the horizontal row (i.e., a low count). Where the vertical sections fit closely with the comparatively large number of apples in the horizontal rows, a "close pack" is produced (i.e., a high count).

With most varieties of apples, the open pack is recommended, since this method does help to fill the box—in some instances, as explained above, with the assistance of pads—to the weight range as shown in the above table. With flat apples, e.g., Bramley's Seedling, it is not always easy to produce an attractive open pack but it can be done. With lightweight varieties, e.g., Lord Derby, the close pack, is advised to reach a weight range of 20 or 40 lb. for half-bushel or bushel respectively.

Box should be Completely Filled Whatever layout is adopted it is important for the box to be completely filled—a part top layer not only spoils the appearance of the pack but may give the wholesaler or retailer the impression that pilfering has taken place or that the box is underweight. Growers who have had difficulty in "standardizing" weight of net contents within economic limits have adopted the method of count. This is very useful to the retailer, especially where fruit is sold by number rather than weight, but the buyer generally expects a box to contain 20 or 40 lb. as the case may be. On the outside of the box there

should be some indication of the contents, showing variety, weight and/or count and grade, and to whom consigned, with the brand or name of grower or farm. The introduction of semi-stiff covers stapled to the boxes has improved the appearance of the finished article.

The above suggestions do not by any means exhaust all the possibilities of making attractive packs in the returnable market container, but it is hoped that they will be of some assistance to growers who have had difficulties in this direction. Unfortunately, it would seem that the returnable wooden container will be the package in which the bulk of home-grown apples and pears will be marketed for some years to come, and if some measure of standardization in packing and presentation can be achieved, it will enable home-grown fruit to compete on more equitable terms with imported fruit, and encourage wholesaler and retailer alike to handle it more willingly, thus improving the demand and breaking down "sales resistance". In other words, better packing will enable the grower of English apples and pears to sell his fruit more readily at a better price.

COURSE FOR LANDOWNERS, 1950

J. E. Thorpe

Country Landowners' Association

"AFTER all, there is a lot in it." While all but the most ignorant townsman would now be prepared to admit this of the farmer's profession, only a mere handful of people would spontaneously make the same comment on landowning. But anyone who attended the three-day course arranged by the Country Landowners' Association for some of its members at the Royal Agricultural College, Cirencester, last April, would appreciate that experience, skill, and technical knowledge are equally necessary in all branches of the industry.

This second refresher course for landowners followed rather similar lines to one held last year, with variations in the themes of the lectures and the farms inspected. There was a new feature giving a touch of light relief, with mingled wit and wisdom—an Agricultural Brains Trust consisting of Major R. G. Proby, M.C. (President of the C.L.A.), the Earl of Radnor, Major W. M. Marriott (agent for the Powis estates in Pembrokeshire), Mr. W. E. Cave, a Wiltshire farmer, and Professor Boutflour as Question Master. More than seventy members of the C.L.A., representing both large and small acreages—from the bleak moors of Northumberland to the hill farms of Merioneth and the little holdings of Cornwall—found the days packed with excursions, lectures and discussions, and many opportunities of ventilating their own problems with their fellows from other parts of the country.

This course, which has now established itself as an annual event, fulfils a rather different function from the estate management conferences arranged by the C.A.E.C's and the A.L.S. in the provinces, in collaboration with the farming organizations. The purpose of these is primarily to put over technical information on fixed equipment, with rather special emphasis at present on farm buildings. The C.L.A. course does not neglect this very important side of estate management, but it approaches the subject from the wider viewpoint of the individual owner bemused by legislation, and harassed

by taxes and building and planning controls. It has, in fact, a rather personal touch. It is this and an element of competition among landowners—even those who attended the previous course—to get in on a good thing, that accounts for its popularity.

Finance, Legislation and Forestry

As seems inevitable at the present time, the recurrent theme of these C.L.A. conferences is estate finances; how to provide the necessary equipment for farms in the most efficient and economic form; whether it is wiser to take advantage of tax concessions to put up new buildings rather than patch old ones; what rates of interest to charge tenants on improvements; whether a new theory of farm rent should be adopted by valuers to take into account the condition of fixed equipment of the farm as well as the customary rent per acre. Discussions ranged over a wide field, but seemed to be drawn magnetically back into the financial channel, which is the landowner's chief preoccupation today.

Perhaps one of the thoughts uppermost in everyone's mind was epitomized by Professor Boutflour, Principal of the College: "Wages are up by 300 per cent, costs by 300 per cent—it's only logical that farm rents should go up too." It was interesting to find this point of view strongly supported by Mr. W. E. Cave, an owner-occupier, whose farms were visited by the party. He even went so far as to say that in his view, if rents were related more closely to the rise in farm profits, it would make for improved efficiency and less scarcity in the market for farms, on the principle of the survival of the fittest. Thrown into the arena by this progressive farmer, that was a fine provocative theme for discussion by the Brains Trust.

The intricacies of the Agricultural Holdings Acts and the landlord-tenant relationship were explained by Captain E. H. Mostyn (Committee Land Agent for E. Sussex) who dealt ably with the many questions fired at him by his knowledgeable audience. Mr. F. G. Holland, the C.L.A.'s Legal Adviser, tackled other legal problems of topical interest to do with rights of way and land within the area of National Parks, and had to face a barrage of tricky questions.

Taxation and estate finances was the subject chosen by the Association's Chairman, Lt.-Col. Walter Burrell, for his lecture. Unfortunately, he was unable to read it in person, and Major Marriott stood in to answer the questions. The owner's present attitude towards improvements was well summed up by Colonel Burrell in these words:

> Priority should be given to those items which will best enable the farmer to make the greatest and most economical use of his available labour. Such items as piped water supplies to fields and buildings save carting and carrying and the unnecessary movement of livestock; electricity saves time in lighting and cleaning oil-lamps and starting engines; modern cowsheds save time in milking, feeding, washing down and clearing manure; Dutch barns save thatching and, if combined with good roads and yards, save time in threshing; more and better roads save time and distance, and labour on maintenance; and the elimination of small and badly shaped fields saves time in all arable cultivations and in the maintenance of fences. It is in this way that the landowner can help to increase production.

One of the most interesting and instructive papers was given by a well-known forester, Captain G. C. Wolryche-Whitmore, who spoke for over an hour without a note on the conversion and use of small timber and thinnings on his estate. There is no doubt that many of his hearers felt they had been wasting a valuable asset. The forestry theme was taken up by Major Proby in his closing address, part of which was devoted to the Dedication Scheme for private woodlands, including an explanation of the negotiations which

led to its acceptance by the C.L.A. and other bodies, and the arguments in its favour.

The main theme of this talk was "Private Landowning—Where do we stand today?" It was an appreciation of some of the owner's current problems against a historical background sketched by Lord Bledisloe in his introductory remarks. It was appropriate that the continuity in the tradition of British landowning should be emphasized by the sole surviving founder of the C.L.A., who, at the age of over 80, is still the first to urge that the private landowner should be a pioneer and leader in the field of agricultural technique.

Emphasis on Dairy Farming

Students on the course had opportunities to see and discuss some of the new ideas being worked out in husbandry on the College farms and in building construction elsewhere. They were privileged to inspect, with expert commentary, several new buildings of outstanding interest for the housing of dairy cattle. Emphasis throughout was mainly on dairy farming: this was almost inevitable in that part of the country, where farmers are thinking in terms of improving up to T.T. standard. The requirements under the Milk and Dairies Regulations were explained in a lecture by Lt.-Col. H. A. Sawyer, who came to the cheerful conclusion that although the new rules appear formidable at first sight, there is a great deal to be said for more uniformity of administration. The new standards, he thought, would in effect be no more exacting from the landowner's point of view, than under the old set-up.

On the many farms seen by the party, it was particularly valuable to be given the costs of various items of the improvements, and to know that much of the building work had been carried out by farm labour under the owner's supervision. Valuable hints were picked up on the Wiltshire downland farms of Mr. W. E. Cave, who has switched from arable sheep farming to milk production. Mr. Cave is a firm believer in the yard-and-parlour system, and we were able to see exactly how he has learned from the mistakes he had made in one set of buildings when he came to design a new one. There was scope for controversy in his system of feeding in an open yard, but only admiration for the safe and simple design of his new bull pens.

Again in pursuit of new ideas in the yard and parlour, the party visited Mr. J. E. Rowe's farm at Andoversford, where several novelties were incorporated in a range of new buildings making use of M.A.F. units. Under one roof there are four covered yards, each holding twelve dehorned animals, a tandem milking parlour and washing stalls, a dairy, two bull pens, feeding passages, and storage accommodation for bedding and fodder. Special features of interest include portcullis gates worked by pulleys and weights at the entrance to the yards, home-made wooden yokes, escape hatches in the bull-runs, and an open ridge for roof ventilation. Silage pits are handy just outside. The building is a good example of what can be done when a team of practical people with a responsive architect put their heads together. Although the capital cost was high (about £77 per cow), Mr. Rowe is convinced that the extra output and saving on labour will justify his outlay by reducing the cost per gallon of milk produced. Moreover, the building is so designed that it can be adapted for other uses, should there be a switch from milk in the farm policy. In long-term planning involving heavy capital expenditure, this is something which the prudent owner must always bear in mind.

The owner who puts up a new cowhouse must reckon that milk production is to be the pivot of that farm in the foreseeable future. In Mr. Gale of Church Farm, Mildenhall, we found a profound believer in the cowhouse,

as against the yard and parlour (nicely summed up by Professor Boutflour as "the difference between the tutorial system and a class of sixty"). This farmer scrapped a milking bail to convert an old building into a modern cowhouse with labour-saving devices. He is well pleased with the saving in labour costs and the health of his cows, and is now embarking on a new cowhouse to extend the herd. A notable feature of his routine is no washing down of cowstalls; ground chalk is scattered and swept up, then fresh straw is laid. There is sufficient fall in the floor for the urine to flow away down the channel; it is then pumped up from an adjacent pit and put on to the pastures to replenish fertility, in default of the old bail, from animals wintered indoors. This owner, who started his career as a successful bee farmer, is not afraid to experiment with ideas which are widely accepted abroad, but which are still looked upon as unorthodox in this country.

By way of contrast to buildings such as these, students on the course were faced with the problem of old buildings in process of reconditioning on an estate with little capital available for improvements. There were lessons to be learned here too; among them that it is doubtful policy to provide a bad tenant with an expensive improvement if he is simply going to abuse it. And there was no lack of keenness among those who attended the course to pick up all the ideas and information they could glean of how to make a good job of managing their estates.

FARMING AFFAIRS

Grassland Fertilizer Subsidy A scheme to encourage the use of fertilizers for improving grassland and marginal land in the United Kingdom is intended to operate from July 1, 1950. Legislation to authorize a subsidy has recently passed through Parliament and full details, including particulars of the kinds of grassland and fertilizers eligible, the different rates of grant that may be paid, and the procedure for obtaining the grant, will be published as soon as possible by the Agricultural Departments. Meanwhile the following information about the proposals will be of interest to farmers.

Occupiers of agricultural land may apply for grants towards the cost of all the fertilizers set out in Part I to the First Schedule to the Fertilisers and Feeding Stuffs Act, 1926, which have been both purchased and applied during a three-year period beginning July 1, 1950, for the improvement of temporary and permanent grassland, rough grazings, and of certain ploughed-up grassland. Any land comprising more than one acre that is used for agriculture will be eligible for grant at the following rates:

Land under Grass. For fertilizers applied to land under grass, *including* land under clover and lucerne, or mixtures of clover and lucerne with grass, and rough grazings, but *excluding* grass orchards and one-year leys, the grant will be at the rate of one-third of the cost of the fertilizers. The maximum amount of grant in each fertilizer year will be 25s. an acre, in respect of fertilizers applied to not more than one-half of the total grassland acreage on the farm.

Ploughed-up Grassland. For fertilizers applied to ploughed-up permanent grass and rough grazings, the grant will be at the rate of two-thirds of the cost of the fertilizers, subject to a maximum grant in each fertilizer year of £3 per acre treated. The land must have been under grass for at least seven years at the time of ploughing.

Full instructions will be issued by the Ministry as soon as possible about the procedure for obtaining grants and the time and manner in which occu-

piers should submit applications. In the meantime occupiers should keep a record of the Ordnance Survey number and acreage of all grass fields and rough grazing land treated with fertilizers purchased on or after July 1, 1950; the kind and quantity of fertilizer spread on each field; the cost per ton of the fertilizers, and the amount of any additional transport costs incurred when the fertilizers are not delivered direct to the farm by the supplier. Occupiers will be required to furnish this information in the forms of application for grant which will be issued by the Ministry.

Those who intend to take advantage of the scheme and are in any doubt about the proper quantities of fertilizers to apply to their grass, should seek the advice of the District Officers of the N.A.A.S., who will also advise as to whether any preliminary operations in the way of surface drainage or liming are necessary before the fertilizers are applied. This applies particularly to rough grazings, as the Scheme will contain provisions for the withholding of grant where, in the opinion of the Minister, fertilizers have not been used economically or to the best advantage.

Inquiries about the proposed Grassland and Fertilizer Scheme for England and Wales should be addressed to the Secretary, Ministry of Agriculture and Fisheries, (Grassland Development Branch), 1 St. Andrew's Place, Regent's Park, London, N.W.1., or to the County Agricultural Executive Committee.

Official Seed Testing Station: Revision of Fees

As from August 1, 1950, the following revised scale of fees will be in operation at the Official Seed Testing Station, National Institute of Agricultural Botany, Cambridge.

	s.	d.	
To Seedsmen:			
Wheat, barley, oats, and rye	3	6	per sample
All field and garden seeds, linseed and flax	5	0	,, ,,
Grasses and clovers	8	0	,, ,,
Forest tree seeds	8	0	,, ,,
Mixtures of grasses and clovers	16	0	,, ,,
Purity tests only:			
Clovers (including examination for presence of dodder)	6	0	,, ,,
All other seeds	One half of the fee for a complete test.		

A dodder test only will be made for 4s. In the case of mangolds or beet an additional fee of 6s. will be charged if information regarding the percentage of sprouts is required in addition to the percentage of germinating clusters. Seeds not coming within the scope of the Seeds Act will be tested at the appropriate rate above, according to the kind of seed.

To Farmers: A report will be furnished at a special rate of 1s. per sample on seed which a farmer himself is proposing to sow. A farmer who requires a test for the purpose of a declaration for sale is required to pay the fee chargeable to seedsmen.

Microscopic examination of samples of wheat for the presence of Bunt spores, either in conjunction with the germination test or separately, will be made for an additional fee of 3s. 6d. Samples of celery seed will be examined for the presence of "Leaf Spot" or "Blight" at a fee of 3s. 6d. per sample. Examinations for other diseases will be undertaken at an appropriate fee—not less than 3s. 6d.

Moisture tests will be made for a fee of 3s. 6d. per sample. Urgent testing will continue to be carried out on payment of an addition of 50 per cent to the scale fee. Firms who open deposit accounts with the Station will in future be allowed a rebate of 10 per cent when a hundred or more samples are sent in one season. The present rebate on samples sent from August 1 to September 15, has been discontinued.

No charge beyond the scale fee will be made for export samples where special certificates may be required.

Courses for Blacksmiths and Agricultural Mechanics Classes to prepare students for the Intermediate examination in blacksmiths' and mechanics' work are being arranged under a scheme recently introduced by the City and Guilds of London Institute. They will be conducted by local Education Authorities in association with the Ministry of Education. A detailed course of instruction has been prepared to extend over three years of part-time study, covering technology, practical work and calculations, science and drawing. The first examination will be held in 1951.

The scheme is designed primarily for the apprentice blacksmith, but many who are already engaged in this work would probably benefit greatly from such training. It is intended to give a sound basis of instruction in those fundamentals of smith's work which are common to all branches of the craft and to provide an introduction to such modern practices as welding, gas-cutting, machine-shop work and general repairs. It is hoped also that the scheme will equip men to meet a very real need in present-day mechanized agriculture. Arrangements will be made later for a final grade examination. Anyone interested in the scheme should get in touch with his local Education Authority.

Mechanized Hop Picking "It is becoming increasingly apparent," says the Wye College Hop Research Department's Annual Report for 1949, "that some form of mechanical picking will eventually be necessary to supplement the hand picking of hops in this country." In the U.S.A. a considerable proportion of the hop crop is picked mechanically, and the American varieties are well adapted to this process. Not so, however, the English commercial varieties, the cones of which are too lax. It is interesting in this connection to learn that many of the new varieties bred at Wye by Professor Salmon are much better adapted than the old-established English varieties to machine picking. The greater density of their cones enables the plucking mechanism to remove them more effectively from the bines. British-made machines are now being produced, and the Hop Department at Wye is following their development with interest and inspecting the various machines in action.

The report is available from the Secretary, Wye College, nr. Ashford, Kent, price 3s.

New British Agricultural Attaché to the U.S.A. Professor R. G. Baskett, Chief Scientific Officer of the Ministry of Agriculture for Northern Ireland, has been appointed to the post of Agricultural Attaché in Washington, in place of Mr. A. N. Duckham, who returned home during July.

Agricultural Adviser to the U.K. High Commission Ottawa Mr. W. F. Darke, at present Secretary (Agriculture) in the Office of the U.K. High Commissioner in Ottawa, has been appointed Agricultural Adviser to the High Commissioner and will no longer act as Assistant to the Agricultural Attaché in Washington.

AGRICULTURAL MACHINERY—ENGLAND AND WALES

1950 CENSUS

Estimated numbers of certain machines and implements owned by occupiers of agricultural holdings, agricultural contractors and County Agricultural Executive Committees in January, 1950, with comparative figures for 1948.

Machine or Implement	*January 1948*	*January 1950*
Tractors:		
Tracklayers: over 6 h.p.	11,550	13,460
Three and four-wheeled Tractors	193,530	245,400
Total Agricultural Tractors	**205,080**	**258,870**
Tracklayers: 6 h.p. and under	2,340	3,080
One- and two-wheeled Tractors	23,860	33,310
Total Horticultural Tractors	**26,200**	**36,400**
Petrol and Oil Engines	173,620	199,170
Electric Motors	60,990	82,920
Wagons and Carts	463,370	403,930
Lorries and Vans	85,860	90,390
Liquid Manure Carts	12,170	12,180
Tractor Trailers	146,680	221,070
Spraying Machinery:		
Power Fruit Sprayers	6,610	8,030
Wheeled and Tractor Mounted Ground Crop Sprayers (a)	3,280	4,190
Mould-board Ploughs:		
Horse: One, Two or Three-furrow	171,180	137,880
Tractor	214,510	263,670
Ridging Ploughs:		
Horse	122,690	115,170
Tractor	35,560	63,100
Cultivators, Grubbers or Scufflers:		
Horse	108,580	95,950
Tractor	100,710	139,830
Hoes:		
Horse	164,430	153,190
Tractor	18,780	40,290
Harrows:		
Disc	65,410	70,180
Spring Tooth	—	84,520
Others	—	386,560
Rollers (b)	193,500	212,980
Corn Drills	89,810	91,340
Combined Seed and Fertilizer Drills	19,680	23,880
Root Drills	84,640	87,170
Broadcasters: Horse and Tractor-drawn	11,340	13,790
Fertilizer Distributors over 5 ft. wide	74,830	88,450
Potato Planters	7,120	10,970
Seedling Transplanters	4,060	5,260

(a) Collected in 1948 as "Wheeled Potato and Charlock Sprayers"

(b) In 1948 included "Presses"

cont'd

Machine or Implement	*January 1948*	*January 1950*
Mowers over 3 ft. wide:		
Horse	135,190	107,620
Tractor	66,710	107,490
Side Rakes and Swath Turners	120,280	130,240
Hay Tedders	46,260	46,240
Hay Rakes	180,050	179,470
Hay Sweeps	87,150	95,740
Hay Loaders	25,770	28,960
Hay, Corn and Straw Elevators	45,620	55,290
Binders	119,080	120,220
Combined Harvester-Threshers	4,970	10,120
Green Crop Cutter-Collectors	800	1,140
Green Crop Loaders	1,000	4,100
Silage Cutters and Blowers	1,050	1,220
Potato Spinners	52,340	59,610
Potato Elevator Diggers and Shaker Diggers	4,600	9,640
Complete Potato Harvesters	(c)	480
Sugar-Beet Ploughs, Lifters and Lifting Attachments	(c)	30,880
Sugar-Beet Toppers	(c)	1,460
Sugar-Beet Lifter-Cleaners	(c)	1,470
Complete Sugar-Beet Harvesters (Combined Topper, Lifter and Cleaner)	230	840
Portable Threshing Machines with drum width 2 ft. 3 in. or over	13,600	13,940
Hay and Straw Balers:		
Stationary	5,800	7,280
Pick-up	1,820	5,020
Loaders (other than hay and Green Crop)		
Tractor Mounted:		
Fork Type	(c)	1,060
Jib Type	(c)	340
General-Purpose Elevator Type	(c)	2,240
Root Cutters and Pulpers	164,120	130,250
Potato Sorters:		
Hand: Not Riddles	25,840	23,580
Power	8,260	12,320
Grinding Mills: power-operated	80,960	81,850
Hammer Mills:		
5 h.p. and under	12,820	4,880
Over 5 h.p.		13,590
Meal Mixers	1,230	1,730
Grass Driers	320	660
Grain Driers	1,130	1,310
Winnowers and Cleaners: power-operated	8,250	7,900
Shearing and Clipping Machines	50,560	48,700
Milking Machines:		
Bucket:		
One and two units	48,130	28,240
Three and more units		35,530
Releaser or Recorder:		
One and two units		1,550
Three and more units		3,850
Total Milking Machines	**48,130**	**69,170**
Sterilizing Installations: (d)		
Electric	39,960	12,100
Other		35,040
Milk Coolers:		
Refrigerated	107,300	23,730
Other		85,670

(c) Not collected

(d) Collected in 1948 as "Sterilizing Chests"

BOOK REVIEWS

Prospect for the Land. L. F. Easterbrook. H. M. Stationery Office. 1s.

This book has been prepared by the Economic Information Unit of the Treasury and the Central Office of Information. It is designed to show the role of agriculture in Britain's struggle for economic recovery. In it the author addresses both countryman and townsman, uses the past, present and future as his canvas, but reduces the whole into a concise, well-written text—no mean achievement.

The text is divided, like Gaul, into three parts. The first section recalls the changing fortunes of British farming over the past 100 years or so. This is by now a familiar story, but Mr. Easterbrook's approach makes for new interest in the subject. For instance, in describing the inter-war period, he speaks of the neglected state of the industry, "... while farmers played the part of agricultural waiters, serving up imported feedingstuffs".

In the second part of the book he discusses the present need to "earn our own way" and the ways in which an efficient British agriculture is essential to the success of this, and to the raising of our standard of living. On the fear of pre-war surpluses reappearing, the author is optimistic, and quotes the creation of the Food and Agriculture Organization and International Federation of Agricultural Producers to show that the world is developing a conscience in matters of food and diet. There have always been hungry people in the world, and the problem of providing these people with the purchasing power that will make short work of any local gluts is not easy; but there is more hope now that these international bodies are growing in purpose and self-confidence.

> "Looking at the situation as a whole then, at the increasing world demand for food, at our lost income for financing its purchase and at the increasing competition our exporters must expect in a world where countries are pressing forward their plans for greater industrialization, looking at the situation quite dispassionately, can one come to any conclusion except that Britain must rely for the whole discernible future upon all the food she can reasonably grow? Even then we may be unable to maintain our population of 50,000,000 at the standards they want.
>
> "So even in the short-term view it would appear that the prospect for the efficient farmer in Britain is just about as certain as anything can be. The national need points to it; so do all the economic trends."

The book ends with a survey of the way ahead. The Agricultural Expansion Programme is given its proper place as the foundation of more intensive but *balanced* farming, with farmers as the master-builders.

M.H.

The Science and Practice of Grassland Farming. H. I. Moore. Nelson. 8s. 6d.

The opening words of the preface "The grass fields of this country are of supreme importance in the economy of the nation" were never more true and they provide ample justification for the emphasis now placed on grass as a farm crop, rather than as a mere cover for bare earth. Efficiency in grassland farming is today an urgent national necessity. Several books on grassland have been published during the last decade but the need to stimulate practical interest continues. In this publication, as in previous ones by the same author, the subject is handled competently and methodically. The evidence which is discussed is based on the writer's own wide experience, on the good work of practical farmers and on the large store of scientific knowledge furnished by grassland research. The data has been blended together to give a concise picture of current grassland thought. The theme in its application to modern grassland husbandry has been systematically developed but it is free from dogmatism. Unanimity of opinion in regard to changing practices due to scientific investigations cannot be expected. Views on this complicated subject—grassland farming—differ considerably but the fundamental principles underlying the successful establishment, maintenance and utilization of grass and grassland products have been expressed clearly.

Among the grassland sections dealt with in the various chapters are the historical background, establishment of leys, manuring, management, conservation, seed mixtures, economics, nutritive value, disease and pests, and hill pastures. Perhaps it would have been appropriate in this book to stress the vital need of growing a considerably larger tonnage of suitable herbage seeds "at home". Complete success in pasture formation from sowings can only be achieved if sufficient good quality seed of the best species and strains are available. The book merits the close study of practical farmers and other students of agriculture. It is easy to read and understand and contains valuable information; it is also well illustrated. For the student a more complete list of references would be beneficial.

M.T.T.

Timber Dutch Lights. British Standard 1612: 1950. British Standards Institution. 2s.

The British Standards Institution, in response to a request from the National Farmers' Union, have prepared a standard specification for Dutch lights constructed in timber. The need for such a standard specification will not be disputed, for anyone who has handled Dutch lights in this country during the past ten years or so must, at some time or other, have been exasperated by the many, though often very slight, variations in structure which occur.

Dutch lights were not used to any extent in this country earlier than about 1930, when they were of one standard size introduced by Dutchmen who settled in the East Riding of Yorkshire about that time. In the twenty years that have followed, many alterations in design, in the materials used, in dimensions, and in weight, have been introduced. To some extent this was brought about by the war, when materials, particularly timber, became extremely difficult to obtain and resort was made to substitutes and to extreme economy in the use of timber.

Supplies of timber are still meagre, and it is reasonable and wise, therefore, to encourage some degree of uniformity in the manufacture of Dutch lights in the future.

The publication of this British Standard is therefore welcome. The specification covers type and condition of timber, type of glass, (clear sheet glass and R quality translucent glass both being admissible), adhesive, nails, dimensions, construction, and other particulars. It is a detailed specification carefully compiled.

With so many variations in common use it is unlikely that the specification will please everyone. It differs, indeed, from the particulars given in Bulletin No. 65 of the Ministry of Agriculture and Fisheries in several details. Firstly the overall dimensions are slightly different (30¾ inches by 59 inches) in place of (31¼ inches by 59 inches), and the framing members are slightly different. Nevertheless the specification is that of a light which is very widely used and gives general satisfaction. It is almost identical with the light in common use in Holland and introduced into this country.

There is one possible improvement that could be made. The wooden glazing stop surely need not be 5 inches long? All that is required is something to keep the glass in place and prevent it slipping out, and this might well be done by something much smaller which would offer less obstruction to water running off the light. If this could be of rubber, or rubber composition it might reduce the risk of fracture to the glass, which sometimes happens if the stops swell when soaked.

H.F.

Wessex (Face of Britain Series). RALPH DUTTON. Batsford. 12s. 6d.

It is very obvious that Mr. Dutton, who lives in Wessex, has a great affection for the ancient kingdom of Alfred. He draws his border on a strange line through Somerset. There is at least a strong tradition for including Frome in the kingdom, and an even stronger one for the claims of Athelney. Personally, I would take all Somerset from the fringes of Exmoor to the Severn at Bristol.

But possibly there was a practical reason for narrowing the Wessex borders: one book is already too short for Dorset, Wiltshire and Hampshire, especially when bits of East Somerset and West Berkshire are added. Mr. Dutton has taken all the chalk country south of the Thames Valley, west of the clay of the Sussex border, and east of the mixed soils of Devon. He shows how geology has shaped the land and its history, and at no point in his wanderings is he far from the chalk, except in the New Forest. Almost everywhere else there is always a ridge of chalk on the skyline.

It is an unusual and very commendable approach to the subject to give a popular but reasonably accurate idea of the very bones of the land. This, with the 120 excellent illustrations, will make the book a very acceptable present to the native of Wessex and to any stranger who seeks its beauties.

Mr. Dutton is more than a mere recorder of facts. He expresses strong likes and dislikes, and with some of them the reader will inevitably disagree. In talking of Broadhalfpenny Down, the Mecca of cricketers, he refers to "this tedious game". As a cricketer this shocks me. Then he finds the ploughing of the downs "turning majesty into bleak squalor" whereas I, as an agriculturist, would have referred to "making the desert blossom".

To the author's love of Wessex must be added an obvious familiarity, but this occasionally leads him to write of some remembered matter without checking his memory. It is not true to say, for example, that Alice Lady Lisle was executed by burning; the sentence was changed to beheading; nor that Charles II tried to escape from the West Bay; it was from a place six miles further west. Queen Elfrida may have moved to Bere Regis after committing murder at Corfe, but she spent most of her later years in a nunnery which she founded at Wherwell.

But these are slight blemishes in an otherwise enjoyable book.

R.W.

Crops and Cropping (Fourth Edition). H. I. Moore. Allen and Unwin. 12s. 6d.

Designed for both students and farmers, this book, first published in 1943, covers a wide range of crop husbandry. It is written in a very interesting and pleasing manner, and the non-technical language will make it acceptable to a large number of readers. The author has illustrated the book to some extent by photographs he has taken himself, and the standard of photography is excellent.

In a book of this kind, it is obvious that a number of aspects must be either omitted or touched upon only lightly, but in these days of mechanization one might have expected some discussion on harvesting—especially with combines, since they are rapidly becoming so prominent in British agricultural practice. Some discussion on depth of ploughing would have been welcome too, having regard to its importance now that we have stronger equipment for working the land.

Special mention must be made of the excellence of the appendices, and especially of Appendix 1, which gives a handy chart of plant pests to facilitate recognition of the damage they cause. Appendix 2 gives similar information in respect of plant diseases.

In the chapter on forage crops mention is made of grass and clover mixtures for ley production, but nothing is said of the management of leys by controlled grazing, etc., perhaps, however, that may be considered to be outside the province of this book. Another small criticism is that the book would gain in practical value by the inclusion of an index.

These criticisms apart, the book is excellent and likely to maintain the interest which farmers and others have already shown in it.

F.H.G.

Chrysanthemums for Pleasure and Profit (Fourth Edition). Roy Genders. Littlebury. 7s. 6d.

Much has been written from time to time about the ever-popular chrysanthemum, and this revised edition of a book first published in 1946 provides further up-to-date reading not only for the keen amateur possessing a few plants but also for the commercial man with several acres at his command. The author is widely known in the North of England as a producer of good commercial plants and flowers, and his exhibits on the show bench have been rewarded with not a little success.

The information given tends to have a commercial bias, and the novice may be rather bewildered by the glib use of technical terms such as "first crown buds" that appear so often in the chapter dealing with the Japanese chrysanthemum.

As regards varieties, the chapters on which are particularly good, a number of the older sorts are given worthy mention along with the more recent introductions. Food for thought is provided for the grower interested in the less common types by the section dealing with the Korean, Liliput and Cascade chrysanthemums. Who knows how soon Woolman's Perpetual White will be offered for sale to the public, in full bloom in April!

Some confusion might be created in the mind of the amateur when he finds that he is unable to control the capsid bug by using flowers of sulphur—recommended on page 58 as a guard against this pest. In tackling a difficult task Mr. Genders would have achieved more success had he dealt with either the purely commercial or purely amateur aspect of chrysanthemum growing.

H.S.C.C.

Wild Animals in Britain. Oliver G. Pike. Macmillan. 18s.

This book will be welcomed by students of our native wild animals, and particularly by those who like an easily understood, down-to-earth account of the lives of the "lower orders".

The book has some novel features, both the dental formulae and the lists of local names being very helpful. Moreover, it has the cardinal merit of having been written very largely from personal experience and observation. The facts are clearly and simply stated, and the type is excellent, but it is a pity that the paper used does not allow of better reproduction of some of the excellent photographs.

Inevitably, there are some points on which other observers will disagree with the author. For example, the normal gestation period of the badger is almost certainly seven months, and recent reliable evidence has shown that badgers mate in July and not in the autumn as stated. Then, the author's doubts as to the ability of the hedgehog to transmit foot-and-mouth disease will not be shared by the veterinary profession. It is, in fact, known that the hedgehog can actually contract this disease.

In passing, assuming that in the term "river" the author includes tributaries, a native of the area might wonder where, on Dartmoor, an otter could be killed "more than ten miles from a river or any sheet of water".

The natural history book that met with complete agreement has not yet been written; probably it never will be. But, these things apart, this latest book of Mr. Pike's is a good one. It makes pleasant and profitable reading for the naturalist of any age, but it would be a particularly useful addition to any school or public library.

F.H.L.

BOOK REVIEWS

Farm Accounting and Management (Second Edition). FORD STURROCK. Pitman. 16s.

Any student who is taught from this textbook will learn not only the accounting system that he is most likely to use as a farmer or farm manager, but also how he can use his accounts and records to improve his management. Firstly, Mr. Sturrock describes the system of accounting commonly known as "the cash analysis method;" this is the system that has been generally accepted by farmers in this country as being the one best suited to their requirements. The exposition of this system is admirably clear, its principles are explained by apt illustrations and the author covers all the points of detail which are likely to arise when farm accounts are kept. There is also a wealth of information on such related subjects as filing, the taking of valuations etc. all of which is of practical value to anyone running a farm business. The second half of the book is concerned with the uses that can be made of accounts, either alone or supplemented by additional records, to discover weaknesses in farm organization and management, and there is a detailed description of the methods that can be employed and many examples illustrating their practical applications. Unfortunately it is more difficult for an individual farmer to apply these techniques than to keep the accounts and records required and it is unlikely that many farmers would care to use them unaided. This part of the book does however show in exact detail what can be done in the field of farm management when the help is enlisted of a professional economist like Mr. Sturrock himself.

A.G.J.

Annuals (Second Edition). ROY HAY. Bodley Head. 12s. 6d.

This is not just another gardening book; on the contrary, it is an authoritative work on annuals—those remarkably accommodating flowers without which our gardens, both public and private, would have an air of something missing.

The book is divided into two parts: the first (a short one) discusses the uses and cultivation of annuals, with some remarks on those which have been lost to gardens. The second part consists of an alphabetical list of annuals, giving country of origin, history, size, colour, and other identifying characteristics.

The cultural directions are simple and direct, and will appeal to that majority of gardeners who wish to grow, for example, sweet peas without the hocus pocus which some advisers on cultivation of this annual of annuals appear to consider necessary.

The section on Shirley Poppies is of particular interest. This variety was derived from the common field Poppy, *P. rhoeas*. The author states that seeds of varieties of *P. rhoeas*, sown in the open towards end of September, produce plants which flower early in the following summer; a true statement which might well have been enlarged by saying that the resultant plants are more luxuriant than those from spring-sown seeds.

G.A.C.

English-French, French-English Dictionary of Agricultural Terms. National Federation of Young Farmers' Clubs. 3s. 6d.

There is not the slightest doubt that this new booklet from the National Federation of Young Farmers' Clubs will be a resounding success. Although prepared for the use of young farmers, particularly as an aid and encouragement to the promotion of their contacts with other young farmers abroad, its value is so patent and its size so convenient that many other people will be asking for it—and indeed won't be happy until they get it. *Tant mieux*!

S.R.O'H.

"AGRICULTURE"

Price 6d. net monthly, post free. (Foreign countries, 8d. post free).

Subscription Rates (including postage):

Inland and Imperial .. .. 6s. per annum
Foreign Countries .. .. 8s. per annum

Subscription may start with any issue and should be sent to

H.M. STATIONERY OFFICE

York House, Kingsway, LONDON, W.C.2 — 429 Oxford Street, LONDON, W.1
P.O. Box 569, LONDON, S.E.1
13a Castle Street, EDINBURGH, 2 — 1 St. Andrew's Crescent, CARDIFF
39 King Street, MANCHESTER, 2 — 1 Tower Lane, BRISTOL, 1
2 Edmund Street, BIRMINGHAM, 3 — 80 Chichester Street, BELFAST

Single copies can be purchased from any of the above-mentioned addresses or through a bookseller.

Printed in Great Britain under the authority of HIS MAJESTY'S STATIONERY OFFICE by Staples Press Limited at their Kettering, Northants, establishment

CATERPILLAR for Economy Every Time!

Regd. Trade-mark

Say Farmers who know!

With 'Caterpillar' firm-gripping tracks you get drawbar pull with no power-wasting wheelspin. With sturdy 'Caterpillar' Diesel engines you enjoy thousands of hours of trouble-free service on the most economical of all fuels. That's the secret of power with economy — helping 'Caterpillar' farmers everywhere to farm more acres at less cost.

Mr. Eric Dring, who farms near Boston, Lincs, says — "I never want to change from 'Caterpillar.' My D4 is still doing a wonderful job. I shall certainly choose 'Caterpillar' again."

LEVERTONS FOR 'CATERPILLAR'

H. LEVERTON & CO LTD · BROAD STREET · SPALDING · LINCS

CRAVEN "HYDRAULUX"

HIGH PRESSURE SPRAYING OUTFITS

For Fruit Trees, Hops, Bushes and Ground Crops

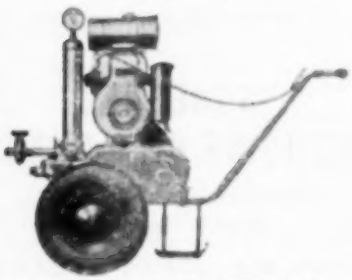


Illustration shows the HYDRAULUX-2 RAM mounted on T handle Chassis. For use in close plantations or greenhouses.

Output 3.5 to 4 gallons p.m. at 100 lb. to 300 lb. p.s.i.

Write for leaflets of Power Dusters and Sprayers to

W. J. CRAVEN & Co., Ltd.,

SPRAYING MACHINE MANUFACTURERS

EVESHAM

MORTGAGE *Loans*

FOR ALL FARM PURPOSES

Loans up to two-thirds of the agricultural value of properties at **4%** *interest*

Do you require —

- ASSISTANCE TO BUY A FARM
- MONEY TO REPAY EXISTING BORROWING AT A HIGHER INTEREST RATE
- NEW COTTAGES
- NEW FARM BUILDINGS
- REPAIRS TO FARM-HOUSE OR BUILDINGS
- DRAINAGE OF YOUR LAND

or improvement to your property

Spread the cost over a term of years by taking a loan on mortgage of your land.

ANNUAL PAYMENT (over INTEREST (4%) and REPAYMENT of the amount borrowed per £100 at end of term)	
30 years	£5 . 0 . 4 per ann.
25 years	£4 . 17 . 10 per ann.
20 years	£5 . 0 . 0 per ann.
15 years	£5 . 15 . 2 per ann.
10 years	£7 . 1 . 4 per ann.
5 years	£12 . 4 . 8 per ann.

(payable half yearly)

- *Appropriate* **Tax Relief** *in respect of interest paid allowed in the current year*

Mortgage loans for improvements in cases where income tax relief is obtained under the Income Tax Act 1945, may be made repayable on special terms.

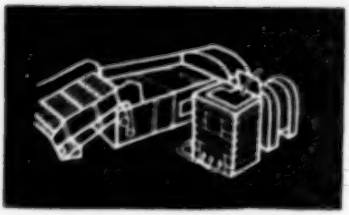
Send for explanatory leaflet to the

Agricultural Mortgage Corporation Ltd

Stone House, Bishopsgate, London, E.C.2

OR ASK YOUR BANK MANAGER

A grand grade for grass drying–



SHELL GAS OIL

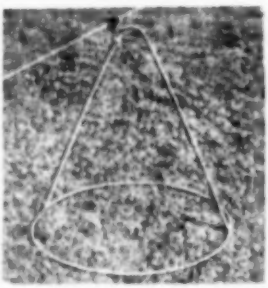
Now is the time to check your storage and make arrangements for supplies of fuel. Be sure also to have your drier ready in good time for the start of the Grass Drying season. If you have any problem to do with the conversion, installation or fuel efficiency of driers, consult your nearest SHELL BP Divisional Office.

SHELL-MEX AND B.P. LTD. Fuel Oil Dept., Shell-Mex House, London, W.C.2.
SCOTTISH OILS and SHELL-MEX LTD., 53 Bothwell Street, Glasgow, C.2.

PORTAPYLONS

(Patents pending) (Trade mark)

Make **STRIP GRAZING**
an economical proposition



The **ONLY** System that can be used **WITHOUT POSTS**

Portapylons permit the Electric Fence to be erected or moved almost at walking pace
ALL necessary equipment supplied

WRITE FOR FREE BOOK
on Controlled Grazing. Comprehensive and instructive

HARVEST SAVER & IMPLEMENT Co., Limited.
The Works, Kirbymoorside, York

J. C. GILBERT LIMITED

Columbia House, Aldwych, London, W.C.2

WHOLESALE IMPORTERS

SCREENED GENUINE BIRD GUANO

(Guaranteed 8-10% Ammonia 28-30% Phosphates)

AND ALL OTHER ORGANIC FERTILIZERS

Consumers are requested to send enquiries and orders through their usual Merchants and Stockists

WINTER SPRAYING
of orchards

All PEST CONTROL winter washes used in our Contract Spraying Services can be delivered to growers who do their own spraying.

The following are available:—

D N 289 Contains no oil to cause bud scorch. Effective at much lower concentrations, DN. 289 is completely soluble at spray dilution, and is unaffected by frost. And it costs less per acre.

OIL-FIXED DNC PETROLEUM — with the ordinary DNC Petroleum egg killing effect is a matter of chance. Oil-fixing gets the DNC right into the egg.

MISCIBLE TAR OIL

PEST CONTROL (U.K.) Ltd. Bourn, CAMBRIDGE

Telephone: MADINGLEY 312

SEED POTATOES

From the best stocks in Scotland, Northern Ireland, England or Eire

J. JOHNSON & SON, LTD.

(Established 1870

GROWERS, EXPORTERS and MERCHANTS

Head Office:
Great Nelson Street, **LIVERPOOL.** 'Phone: North 2077 8 9

Branch Offices:
The Granary, METHVEN, Perth, Scotland. Phone: Methven 236
Lawrence Hill Arches, BRISTOL 5. Phone: Bristol 57695
Water Street, LONDONDERRY, N.I.
Phone: Londonderry 2738
The Square, KILKEEL, Co. Down, N.I. Phone: Kilkeel 331
Smethcote, Upton Magna, SHREWSBURY.
Phone: Crosshouses 259

Also HAVERFORDWEST and CAMBRIDGE

Experimental plots open for inspection on our own farm in Cheshire. All seeds packed under our celebrated "SUN BRAND" design.

SEED POTATOES are a matter of trust between buyer and seller, so place your orders with an old-established reliable House!

If you are interested in quantities of less than 6 cwt. and down to 14 lb. of any variety, please write our Associate Company— S. & W. YOUNG LIMITED, *SEED POTATO MERCHANTS, GT. NELSON STREET, LIVERPOOL 3, who handle exclusively our Seed Potatoes in small quantities.*

TURNEYS

ENGLAND'S BEST CHICKS

THE "STANDARD" SET BY

TURNEY BROS.
QUINTON GREEN, NORTHAMPTON
TELEPHONE : ROADE 220

And the next subject is . . .

RELIABILITY

It's technically 'abstract' ; but it has very strong animal connections

That's because we are thinking of it in connection with VITAMEALO rations and in particular the base—or concentrate—on which they are built. Reliability is the factor on which all farmers depend. Successful farmers know they have it in VITAMEALO—for it arises from the quality, consistency and good results from VITAMEALO rations on which they know they can so utterly and always depend—just as they can also depend on the prompt and efficient service of the corn merchants who sell them.

It is for these reasons that successful farmers stipulate that the concentrate in all their rations shall be

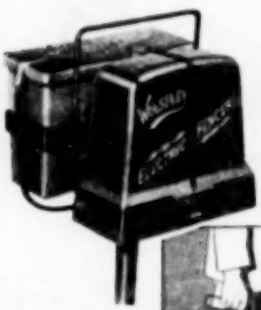
Vitameal

the concentrate with the service behind it

Write for full range of literature including "The Story behind Vitameal"—free from Dept. 3(P).

AGRICULTURAL FOOD PRODUCTS LTD.

23, Upper Mall, Hammersmith, London, W.6. Northern Branch, Saltney, Chester.



Wolseley BELL SHAPE FENCER

The Bell Shape Fencer is the latest addition to the Wolseley range and has been designed expressly for the successful operation of the Rotational Grazing and Kale folding systems. This fencer is a complete unit, easily transported and quickly installed. No screws or bolts, fixed in a few seconds.

WOLSELEY

WOLSELEY SHEEP SHEARING MACHINE Co. Ltd.
WITTON · BIRMINGHAM · 6

potato blight ★
and other
fungus diseases

★ CONTROL and PREVENT BY SPRAYING WITH

BORDEAUX MIXTURE

The mixture should only be made with the best quality

SULPHATE OF COPPER
Guaranteed 98/100%

SULPHATE OF COPPER
is also most effective in killing the mud snail which carries the

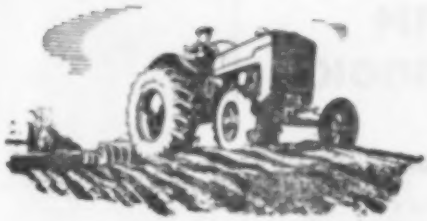
LIVER FLUKE

BRITISH SULPHATE OF COPPER ASSOCIATION LTD.

1 GT. CUMBERLAND PLACE, LONDON, W.1

'Grams: 'Britsulcop, Wesphone, London" 'Phone: Paddington 5068/9

FARMERS AGREE



It pays to say **ESSO**

TRACTOR VAPORISING OIL

ANGLO-AMERICAN OIL COMPANY LTD. 36 QUEEN ANNE'S GATE LONDON, S.W.1

By Appointment Seedsmen to H.M. The King

DUNNS FARM SEEDS LTD.

SEED SPECIALISTS
SALISBURY

Scientific Adviser :
Sir R. GEORGE STAPLEDON,
C.B.E., M.A., F.R.S.

Dunns Guide to Seed Wheats, Autumn Sown Cereals and Forage Crops
Post free

Winter Grazing on Hill Farms
by J. Houghton Brown
16 4to pages. Price 6d. post free.

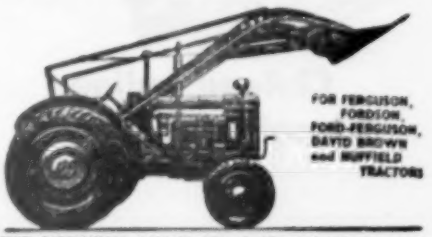
DUNNS FARM SEEDS, LTD.
SALISBURY

Telegrams— Dunnseed Salisbury
Telephone— Salisbury 3247/8/9

ONE MAN CAN LOAD 12 TONS IN 20 MINUTES One man can dig the muck out of a yard, lift it and load it without leaving the tractor seat. He can lift, carry and load sacks of corn, bales of hay or straw—*singlehanded*. The well designed Horn-draulic, powered by the tractor's hydraulic system quickly put on or taken off, lifts half-a-ton eleven feet and needs no maintenance. Over 250,000 Horn-draulics are in use in Britain and America. Price with tined muck bucket £90. *Alternative working attachments extra.*

WITH THE

Horn-draulic LOADER



FOR FERGUSON, FORDSON, FORD-FERGUSON, DAVID BROWN and NUFFIELD TRACTORS

STEEL FABRICATORS (CARDIFF) LTD., ROATH, CARDIFF. Tel. 44434

USEFUL FARM HANDBOOKS

IODINE FOR ANIMAL NUTRITION

This booklet outlines the place of iodine in animal nutrition. It shows how lack of iodine is associated with infertility, still-births, low milk yields — and how this lack can be remedied.

MASTITIS

How to recognize, treat and prevent mastitis, with details of how the iodized oil treatment has succeeded after other treatments failed.

GOITRE IN ANIMALS

Goitre is the most obvious sign of gross iodine deficiency — but far more common and more costly are the border-line deficiencies which make animals poor doers with weak offspring. This booklet shows how the trouble arises and how it can be corrected and prevented.

Simply tick any of the above booklets you would like, tear out this list and send it with your name and address for free copies.

Chilean Iodine Educational Bureau

28, STONE HOUSE, BISHOPSGATE, LONDON, E.C.2

All liners stretch with use. With the Fullwood S-type teat cup, constant tension of the liner is maintained throughout its life. It is quickly and simply assembled and is very robust. It is the last word in teat cup design.

RECORDER RELEASER & BUCKET TYPE PLANT

R. J. FULLWOOD & BLAND LIMITED

ELLESMERE, SALOP & 31 BEVENDEN ST., LONDON, N.1

Ellesmere 29 and 169 *Clerkenwell 4406/7*

No connection whatever with any other British or Foreign manufacturers of Milking Machines.

COPPER COMPOUNDS

in Agriculture

This C.D.A. book deals with the prevention of the loss of potatoes due to blight. It also surveys the uses of copper compounds in protecting certain other crops from fungus diseases and in combating 'deficiency diseases' in plants and animals due to lack of copper in the soil. A copy may be obtained by any applicant genuinely interested, free of charge or other obligation. For this or any other information on the uses of copper, write to the Copper Development Association, Kendals Hall, Radlett, Herts. (Radlett 5616)

CC/55

FARMING THROUGHOUT THE WORLD

Llamas are bred extensively in South America, where they are used principally as beasts of burden. They have, apparently, an unpleasant habit of spitting at anyone who annoys them, which, considering their diet of a handful of maize a day, is probably justified.

In **BRITAIN.....*it's***

BIBBY

A FEED FOR EVERY NEED

J · BIBBY & SONS LIMITED · LIVERPOOL · 3

It's Fisons for Fertilizers

Obtainable from Agricultural Merchants or direct from the following Sales Offices:

Berwick-on-Tweed, Burntisland, Edinburgh, Lincoln, Newcastle, Newport, Widnes, Plymouth, York and

Head Office:

FISONS Limited, Harvest House, IPSWICH